

MEXICO
Introduction of Climate Friendly measures in Transport

Project Concept Document

Latin America and Caribbean Region
LCSEN

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Source	Local Foreign Total
BORROWER/RECIPIENT	2.40 0.00 2.40
GLOBAL ENVIRONMENT FACILITY	5.80 0.00 5.80
SHELL FOUNDATION	1.00 0.00 1.00
FOREIGN PRIVATE COMMERCIAL SOURCES (UNIDENTIFIED)	3.00 0.00 3.00
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Borrower/Recipient: BANOBRAS Cofinancing will be provided by the Center for Sustainable Transport (US\$1 million, annex 7) and private commercial sources Responsible agency: SECRETARIA DE MEDIO AMBIENTE Secretaria de Medio Ambiente (Environment Secretary for the City) Address: Plaza de la Constitucion No.1, 3er Piso. Col. Centro Contact Person: Claudia Sheinbaum Tel: (52) 555 5420 117 Fax: (52) 555 512 2688 Email: Lelena@Dgpa.Df.Gob.Mx Other Agency(ies): Secretaria de Transporte y Vialidad (Secretary of Transport) Address: Versalles No. 13, Col. Juarez. Delegacion Cuauhtemoc. Contact Person: Silvia Blancas Tel: (52) 555 208 1170 Fax: (52) 555 5333 909 Email: silvia_blancas@hotmail.com Sistema de Transportes Electricos (Electric Bus Operator) Address: Municipio Libre Oriente No. 402, 3er Piso. Col. San Andres Tetepilco Contact Person: Florencia Serrania Tel: (52) 555 539 1584 Fax: (52) 555 392649 Email: director@ste.df.gob.mx	
Project implementation period: 2002-2007	

A. Project Development Objective

1. Project development objective: (see Annex 1)

The project development objective is to contribute to the development of policies and measures that will assist in a long-term modal shift toward climate-friendly, more efficient and less polluting, less carbon intensive transport in the Mexico City Metropolitan Area (MCMA). Specifically, the project will support aspects of the recently completed Air Quality Management Plan (2002-2010) which are consistent with the GEF operational program on sustainable transport (OP-11) and the Climate Action Plan for Mexico City¹.

2. Key performance indicators: (see Annex 1)

To ascertain, whether or not the project has achieved its development objective, and as broad performance indicators, the following actions would have been carried out: (more specific performance indicators are included in Annex 1)

- (a) the harmonization of sector planning in the environment, transport and urban development as it relates to air quality measures;
- (b) the adoption and initiation of a Climate Change Action Plan in transport and associated measures;
- (c) the adoption of organizational and barrier removal measures to facilitate the implementation of sustainable, climate friendly transport strategies;
- (d) the examination of less polluting, climate friendly transport alternatives through a comparative field test that will produce results from which decisions on alternative transport will be made;
- (e) the incorporation of climate change issues in MCMA transport projects in their design and operation;
- (f) the increased use of high capacity vehicles, non-motorized modes of transport as well as the increased public awareness of the advantages of transport corridors and climate friendly technologies;
- (g) an effective project management.

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)

Document number: **Date of latest CAS discussion:**

The project is part of a 10 year multi-sector program by the metropolitan authorities (State and City), outlined in the Air Quality Management Plan (AQM-III; 2002-2010) that seeks to contribute to improvements in air quality in the MCMA through the reduction in the emission of criteria pollutants, therefore reducing human exposure and improving health indicators for the large area population. The program focuses on reductions in emissions of particulate matter, ozone precursors and emissions of greenhouse gases from mobile and fixed sources in the MCMA, of which the transport sector has been shown to be a large contributor. The GEF proposal makes part of the larger effort to achieve these reductions and harmonize said efforts with investments that would mitigate greenhouse gases from the transport sector. The effort supported by the proposed GEF operation will promote the introduction of climate-friendly measures and technologies that would contribute to the sustainability of the transport sector.

The problem of Air Pollution in the Mexico City Metropolitan Area

Air pollution in the MCMA is a serious health and environmental concern. The MCMA constitutes one of the three largest metropolitan areas in the world². There are 18 million inhabitants living in the MCMA³, equivalent to about 19% of the country's entire population, which are being exposed to high levels of ozone

and particulate matter. The MCMA also produces more than a third of the national GDP and generates, in the process, 4 million tons of solid waste per year, and several million tons of atmospheric pollutants. Thus, it constitutes the largest area-source of pollutants in the country and it is one of the largest in the Americas. Current projections indicate that population will continue to grow at an annual rate of 1.6% in the short term. Demand for services and energy however, are expected to increase at even higher rates. This will result, unless controlled, in higher pollution loads to already burdened air and watersheds.

Air pollution in the MCMA is mostly due to (a) a high concentration of ozone, produced by the reaction of volatile organic compounds and nitrogen oxides in the presence of sunlight; (b) carbon monoxide, nitrogen oxides, sulfur dioxide and hydrocarbons emitted by vehicles fueled with gasoline and diesel; (c) sulfur dioxide emitted by industrial processes and commercial services using liquid industrial fuels; and (d) particulate matter (PM) in the form of particles smaller than 10 microns (PM10) emitted by several sources using diesel and other fuels as well as stationary and natural sources.

Third Air Quality Management Plan (Programa para Mejorar la Calidad del Aire ZMVM 2002-2010)

In response to the current challenge, the Mexican authorities have been working on air quality improvements for several years and the results of previous work have produced important, albeit not yet sufficient progress. Early last year the Mexican authorities decided to continue the work already initiated, first and foremost through the formulation, design and implementation of the third Air Quality Management in the MCMA (AQM-III: 2002-2010). Multi-disciplinary teams were organized that include some of the top government authorities in each field (v. gr.; Secretaries of Transport, Urban Development and Environment). The thrust of the effort was: "to improve health indicators through reductions in exposure of populations to airborne pollutants". The AQM-III was published on February 11, 2002.

The AQM-III provides the strategic framework to guide necessary immediate interventions, and to further define, the goals and priorities, while identifying barriers and required reforms. The plan coalesces a significant amount of dispersed information on air quality issues in Mexico City. These valuable materials have been integrated into a comprehensive assessment providing the basis for a long-term strategy to address air quality in the MCMA. Priority under the AQM-III is given to efforts to reduce particulates and ozone, both of which have been shown to have unsustainable impacts of health and the environment. While the linkage between particulates and mortality has been clearly established, the magnitude of the ozone issue (320 days exceeding the norms in the MCMA) and its documented impacts on health require that both criteria pollutants be given priority. The plan identifies the transport sector as a priority area for efforts to curb air pollution.

The Bank has assisted the formulation of the plan through: a) support to the preparation of the 1998 emissions inventory; b) quantification of the health impacts associated with poor air quality; c) formulation of harmonization measures that could jointly address local air quality issues and emissions of greenhouse gases (climate change); d) modeling of the air quality in the metropolitan area and modeling of the measures; and e) economic assessment of alternative courses of action (alternative control scenarios). This effort was undertaken during 1999-2001 as part of sector work that would in turn permit the visualization of specific interventions that could be funded through the Bank as a continuation of the First Air Quality and Transport Project. This first project has been completed in a satisfactory manner.

Health Costs of Air Pollution

While previous efforts in air quality management have yielded dramatic reductions in lead concentration, emissions of CO and sulfur dioxide, ozone concentrations have remained high, often exceeding acceptable

levels. PM levels are also high along heavily congested zones and in areas under the direct influence of wind erosion of denuded land. Abatement of these contaminants remains a first priority for subsequent efforts since they have been directly linked to respiratory illnesses and mortality.

Under the valuation of health impacts study, recently completed with Bank support as part of the assistance to the formulation of the air quality management plan, an economic valuation of benefits from reducing pollution in the MCMA, has been completed. For purposes of the study, the main economic rationale for controlling emissions was the welfare gain from improvements in air quality. The health hazards associated with ozone and PM10 were reviewed because these substances are the most important in terms of violating pollution standards. Their concentration levels depend on the amount and location of emitted pollutants, geographical characteristics, meteorological conditions, and atmospheric chemistry and transport. The chemistry of ozone formation is complicated and nonlinear: under certain conditions, an increase in NOx emissions could reduce ozone concentrations. On the other hand, PM10 pollution stems mainly from direct emissions of particles, and from reactions of NOx, and SO2 with other substances in the atmosphere. Likely emission sources are building and construction (road construction), transport vehicles, forest fires, open-air refuse burning, some manufacturing industries, and re-suspension of road dust.

The study concludes that the annual benefits of a 10 percent reduction in ozone and PM10 is \$759 million. High and low estimates of the value of a 10 percent reduction in PM10 are \$1,607 million and \$154 million, respectively. Obtaining air quality compliance (AQS1) offers benefits of approximately \$2 billion per year, with high and low estimates of benefits of some \$4 billion and \$400 million, respectively. These results highlight the urgency of dealing with the air quality issue in the MCMA (For additional details please see "Improving Air Quality in Metropolitan Mexico City. An Economic Valuation. World Bank; February 2002).

Linkage to the Air Quality and Transport Project and timing of the GEF Project

A proposed Bank loan ("Second Air Quality and Transport Project") is being prepared as part of the program of assistance from the Bank in support of the goals of the AQM-III. Its project development objective is to reduce the pollution load into the air shed of the MCMA contributed by the transport sector (both passenger and cargo), while improving the safety and efficiency of urban transport management at the metropolitan level. This will be sought through enhancing the use of high capacity transport modes, including the inter-modal substitution from small to high capacity vehicles and strengthening the control of emissions from cargo transport, focusing on the development of transport corridors. These corridors would include exclusive busways, transfer stations and a strengthened linkage to the metro. However, there are a number of policies and measures that need to be enacted and options to be examined to make viable the long-term modal shift intended for the transport system and that would be supported by the Bank. This long-term modal shift is also central to the goals of the Plan Integral de Transporte y Vialidad (2002-2006). However, the loan can not proceed without the removal of barriers. This is precisely the objective of the GEF project. Commitment to the loan remains strong but it required the removal of barriers and also the completion of the studies that design the physical infrastructure for the corridors including any safeguard issues.

This GEF project, which would be processed before the loan, would assist in this process by facilitating the adoption of policies and measures needed to achieve the loan's objectives. During the project, options will be identified, decisions taken, and reforms implemented on regulatory issues that will ultimately remove barriers for the effective implementation of the proposed corridors. In this context the GEF project is also a platform for policy dialogue on sustainable transport. From a climate change perspective, efforts to promote a modal shift are anticipated to result in reductions of greenhouse gas emissions per passenger-km;

also support for non-motorized transport and for the use of climate friendly (high efficiency, high occupancy) vehicles would result, when utilized in further reductions in emissions of greenhouse gases.

The GEF project however would stand on its own even if the loan does not materialize, as it will contribute to the development of background data, studies and review of policy options required for the reform process and would contribute to the acquisition of data of global value. In any event, the proposed activities under the loan could not be initiated before these preparatory activities take place. The Bank loan assumes that these barriers will be addressed prior to its involvement. Hence the timing of the GEF project, which primarily addresses the removal of these barriers. The GEF project addresses both regulatory and market barriers. Also, the earlier implementation of the GEF proposal is expected to maintain the momentum achieved during the sector work in the formulation of the AQM-III and continue to yield policy developments that are necessary for the proposed loan to be effective. The continuum of the GEF project and the proposed loan is further described in Annex 4.

Preparatory activities for the loan are being supported through a newly approved PHRD grant for US\$1.3 million, which is intended to finance the design of the corridors and of the monitoring network, and through a German Trust Fund for US\$76 thousand which will help finance the identification of alternative corridors. These activities are in the process of being launched and together with decisions being taken by the Government authorities, will constitute the basis for the PCD. The PCD will be finalized by the end of calendar year 2002. As part of the preparation activities for the loan, the analysis of impacts of the corridors on job generation and any potential safeguard issues will be addressed.

Linkage to CAS

The CAS identifies three core themes for World Bank Group Assistance to Mexico – social sustainability, removing obstacles to sustainable growth, and effective public governance. The CAS also includes, as part of the environmental agenda, promotion of institutional development, decentralization of environmental management, and mainstreaming of global issues in order to comply with international agreements. The CAS specifically identifies climate change as an issue of relevance in Mexico due to: a) the impacts and needs to adapt to these changes (vulnerability to climate change and adaptation needs); and b) the opportunities for Mexico to participate in Carbon Finance and eventually the Clean Development Mechanism as a tool to promote sustainable development. Mexico has already signed the Kyoto Protocol, which deals with climate change and the control of anthropogenic emissions of greenhouse gases, including methane. The proposed project supports all of the above sector goals. It would above all contribute to the goals of sustainable development by contributing to sustainable transport strategies, improve service delivery in the transport sector, support development of an efficient transport sector and contribute to institutional strengthening efforts.

1a. Global Operational strategy/Program objective addressed by the project:

The project is consistent with the objectives of GEF Operational Program 11: Promoting Environmentally Sustainable Transport. Under the OP, a first approach would promote the application, implementation, use and dissemination of commercial and near-commercial climate-friendly technologies where a reduction in greenhouse gas emissions would result. A second approach of this strategy is to reduce costs of prospective technologies that are not yet commercially viable, to enhance their commercial viability. Under this component, GEF attempts to enhance the viability of new emerging sustainable transport measures by supporting demonstrations of measures where the primary market is in recipient countries. Support under this component is important for solutions to transport problems in large metropolis. GEF would also support awareness building, assessment and analysis, institutional reform and strengthening,

policy adjustments, regulatory measures and strategic transport and land-use planning. Information dissemination and public awareness campaign will be integral to widespread successful examples to raise the acceptance of climate friendly transport options.

The global objective of the program is to reduce the emission of GHG from passenger ground transport systems in large metropolitan areas. The introduction of policies and measures supported through the project in the MCMA, will contribute to reductions in the emissions per vehicle of GHGs. In the longer term, the project is intended to promote a shift to a sustainable, cleaner, less GHG emitting ground transport system for the MCMA. This shift complemented with long-term promotion of public transportation is expected to result in substantial global impacts. The results of the field test of bus technologies will have global application.

Climate Change Related Policies and Institutions in Mexico

Mexico has played an important role in the Convention and the subsidiary meetings. It is the first country in Latin America to submit the Second Communication. Mexico is also one of the two largest emitters of GHG in the region and also a country that has shown substantial vulnerabilities to the impacts from Climate Change.

The preparation of the Second National Communication of Mexico on Climate Change began in 2000. The document includes the updating of the National Greenhouse Gas Inventory for the period 1994-1998, scenarios of future emissions, assessment of mitigation policies, scientific and technical research, Activities Implemented Jointly (AIJ), the Inventory for land use and land use change for 1998 (annex to the communication), the process of validation of the National Forest Inventory and, International Cooperation. In this framework, the development of projects on local and global pollution in Mexico City are of great importance for climate change, given the relationship between improving air quality and the necessary reduction of the burning of fossil fuels in the Metropolitan Area of the Valley of Mexico and the significant contribution that the Metropolitan Area makes in terms of total emissions of GHGs.

Parallel to the communications to the convention, Mexico has launched an effort to strengthen its institutional capacity through the development of a Climate Change Office and the organization of a Climate Change Inter-secretarial Committee. The Office has been supported through an IDF grant that enabled the completion of baselines for the energy, forestry and industrial sectors. The IDF also supported the identification of economic instruments for the internalization of climate change concerns in economic planning. This work is being used as the basis for a proposed National Strategic Study on the optimal use of the CDM in Mexico. The Federal government published the Climate Change National Strategy in April 2000. Nevertheless it is not considered a regulatory or legislative tool. The Environmental and Natural Resources Secretariat (SEMARNAT) internal regulation code specifies the climate change duties of the National Institute of Ecology (INE) regarding the studies and research, as well as the National Communications.

In April 1997 Mexico established the Climate Change Intersecretarial Committee, integrated by different state secretariats (e.g Energy, Environment and Natural Resources, Social Development, Foreign Affairs etc.). Among the committees principal duties are: a) The elaboration and presentation of the climate change national policy to the Executive; b) The elaboration of the national strategies and supervision of its implementation; c) Updating and developing the legal framework of policy regarding climate change; and d) The promotion and implementation of climate change laws. These duties are expected to transform this committee into a climate change commission.

At the local level, the SMA is responsible for the implementation of Climate Change policy of the city in coordination with federal authorities. In fact, it is developing the Climate Action Local Strategy of the MCMM which objective is to combat the problem of local climate change.

2. Main sector issues and Government strategy:

2.1 Sector issues

Need for a better harmonization of sector policies on the issue of Air Quality and on Climate Change

The metropolitan authorities have adopted comprehensive sector policies that already identify priority areas in transport, air quality and urban development (Programa Integral de Transporte y Vialidad (2002-2006), the Programa General de Desarrollo Urbano (2002-2006) and the Programa de Medio Ambiente (2002-2006)) of the City. However, there is a need for the sector authorities to harmonize the different programs as these relate to the issue of transport and air quality. Also, even though awareness and activism in international fora have increased, climate change issues have not been fully integrated into the sector planning and decision-making. Successful incorporation of climate-friendly policies and measures will depend on the extend to which sector planning recognizes the harmonization potential between climate change and sector policies, and the realization of local co-benefits from actions on climate change concerns.

Lack of coordination between the air quality, transport and urban planning strategies may result in failure to capture gains in efficiencies or may result in sectoral actions that would be counterproductive for the goals of the other sectors. Transport planning strategies that are coordinated with the air quality management plan would ensure that the efforts and allocation of resources of the metropolitan area that may result in higher levels of emissions of local and global pollutants are avoided. Harmonization with urban planning would ensure that land use and transport planning are also examined from an air quality perspective. The overall intended benefit from harmonizing these strategies is that the efforts in the environmental front are coordinated with similar efforts in transport and land use.

Likewise, the contamination caused by the transport sector is a problem of metropolitan dimension. Mexico City and the State of Mexico have each, their own independent institutional organizations. Even though there is substantial across-the-board technical and institutional capacity, the coordination between them is limited. Due to the fact that the Mexico City and the State of Mexico share an atmospheric basin the problem needs to be addressed by both administrations in a coherent manner.

Transport Sector and Air Quality Issues

i) Lack of a sustainable business environment for public transport

The business structure of bus services in the Mexico City Metropolitan Area (MCMA) has led to highly inefficient operations, resulting in a costly, unsafe and environmentally unsustainable public transport system. The key issues are: a) lack of an organizational model that would facilitate efficient public transport operation in the metropolitan area; b) dispersed operations that hinder the effective control of bus services and contribute to traffic congestion; c) an incentive scheme that maximizes time of buses on the road instead of promoting their efficient use; d) deficiencies in bus inspection and maintenance; e) lack of professional management among bus operators; f) lack of coordination between transport operations in the

State of Mexico and the City; g) a fare system which penalizes transfers and thus discourages intermodal movements; and h) poor coordination between bus services and the metro. These barriers are significant and require of substantial efforts at the policy and regulatory levels.

The experience of the Trans-milenio Bogota's innovative bus corridor system (see Annex 5) – demonstrates that the creation of the right business environment is vital for achieving sustainable public transport services by improving their commercial viability. The Bogota reforms included - in addition to such physical works as busways, terminals and on-line bus stations: a) a payment system that provides the adequate incentives for investors; b) a client-friendly fare structure that is attractive to bus passengers; (c) a regulatory framework encouraging management structures that lead to commercially efficient bus operations; and d) transparent oversight and enforcement mechanisms. These aspects can be improved in Mexico and would be addressed as part of the reform to the regulatory system, envisioned as the key output of the GEF project. The Transmilenio program has resulted after one year of operation in a 400,000 passenger day ridership along transport corridors of very high capacity vehicles. This is a significant modal shift.

ii) Large contribution of the transport sector to the problem of air quality

Under the Programa Integral de Transporte (2002-2006), the transport authorities of Mexico City and the State of Mexico are attempting to address the growing demand for transport while minimizing its already large environmental impacts. However, the number of vehicles in the area is high for the available infrastructure, resulting in road congestion, large fuel consumption, unsafe conditions and high level of emissions. In particular, the nature of the bus sector for the MCMA is of a very fragmented supply, which also results in a somewhat chaotic provision of services. Likewise, the increasing number of private cars exacerbates traffic congestion, which contributes to productivity losses, and higher level of emissions of criteria pollutants. According to the recently released emission inventory and the "Programa para Mejorar la Calidad del Aire (2002-2010), the mobile sources account for a majority of NO_x emissions, 40% of HC emissions and about 36% of particulate emissions.

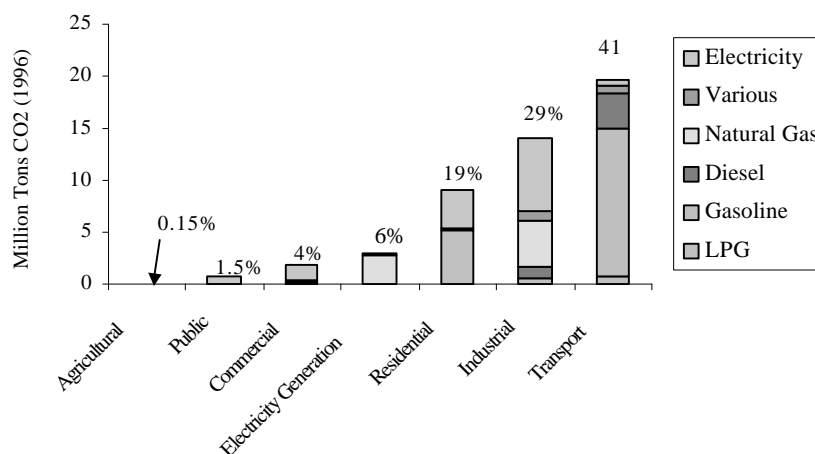
Table 1. Emission Inventory in the MCMA 1998 (percentage)

SECTOR	PM₁₀	SO₂	CO	NO_x	HC
Stationary sources	16	55	0.5	13	5
Area sources	8	24	1.5	5	52
Soils and vegetation	40	N/A	N/A	2	3
Mobile sources	36	21	98	80	40
Total %	100	100	100	100	100

In addition to the large contributions to the release of local criteria pollutants, the transport sector in the MCMA is the largest contributor of greenhouse gases (see Figure 1). Mexico, is the largest contributor of CO₂ emissions (2.1%) in the Latin America region. The recently concluded COP-7, in Marrakesh, Morocco, has again emphasized the need for urgent action to reduce anthropogenic emissions of greenhouse gases and took actions to promote Carbon finance between Annex 1 (developed) nations and developing countries. The Kyoto protocol has now been endorsed by a majority of the community of nations. The carbon trade has thus been reaffirmed and emissions trading of about 700-1000 millions tons of Carbon Dioxide equivalent is expected on an annual basis for the first commitment period (2008-2012).

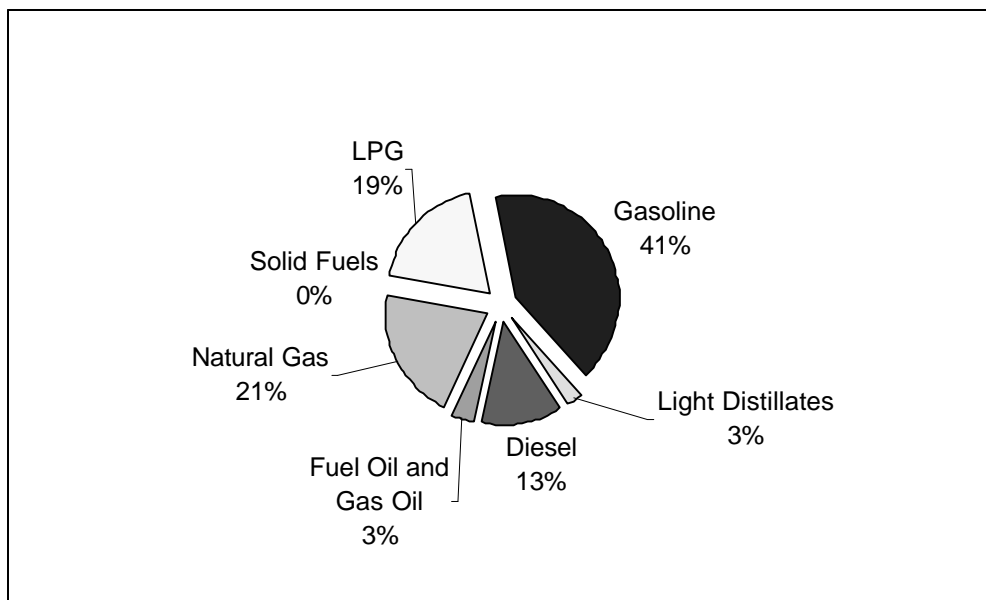
The 1998 energy balance for the MCMA has been calculated using the methodology and format utilized by OLADE⁴. The estimates show that the MCMA consumes 592 PJ annually, for which it requires a gross supply of 648 PJ (56 PJ are used in the transformation process). The largest user is the transport sector, accounting for 49% of the total (292 PJ), an overwhelming fraction of which is provided through the combustion of gasoline in motor vehicles (190 PJ)⁵. A GHG emission inventory was calculated on the basis of the energy balance, following the IPCC methodology. The study estimates emissions of 44.6 million tons of CO₂ equivalent into the atmosphere during 1996⁶ as a result of energy consumption. Of those, 34.9 million tons of CO₂⁷ equivalent were released as a result of fuel emissions in all sectors, while 10.7 million tons represent emissions associated with the generation of electricity⁸ used in the MCMA. This volume of GHG represents 10.3 % of the total national emissions for that year⁹. The largest sector in terms of greenhouse gas emissions is transport with 18 million tons of CO₂ equivalent in 1996 and 19.6 million tons of CO₂ in 1998.

Figure 1. CO₂ emissions by sector and source in the MCMA (1996)



The transport sector is also the largest source of methane (CH₄) and VOCs. Methane emissions have a large radiative effect in the atmosphere, while VOCs contribute to the generation of Ozone. Ozone itself has a warming effect of about one quarter that of CO₂ on a molecular basis. As the transport sector is also the largest source of local criteria pollutants, opportunities for harmonization of local/global pollution problems in the transport sector would have significant impacts in both areas of concerns.

Figure 2. Direct CO2 Emissions by Fuel in the MCMA (1996)



Does not take into account associated fugitive emissions or leaks.

iii) Congestion and low productivity in the transport sector

Traffic congestion affects public transport efficiency and, in addition, imposes direct and indirect costs on the urban economy. Time lost in traffic can add up to a substantial share of a city's output as it reduces the size of the effective labor market, imposes the need for higher inventory and more generally affects individual productivity. In Mexico, between 1990 and 2000, the number of motor vehicles on the road grew by 42%. At the same time, the population of Mexico's medium and large cities grew by 25%, while the number of trips grew even faster than the population. Inefficient public space management, including the lack of properly designed traffic signs and signals, uncontrolled vehicle parking, and inadequate facilities for pedestrians and other non-motorized traffic, contribute significantly to the congestion problem. Commercial transport of freight is affected by congestion in central business districts, poorly maintained road surfaces and inadequate terminal facilities. In addition, in many cities, the aging fleet of highly polluting diesel buses will soon require replacement if air quality is to be managed effectively. The municipal governments are poorly equipped to manage these challenges. This results in limited coordination in intermodal services. Second, Mexican municipalities have limited land use planning powers. Third, the allocation of responsibilities between states and municipalities is inefficient, which makes long-range land use planning difficult. Finally, municipalities have limited resources with which to fund investment in transport infrastructure. The MCMA typifies the difficulties c

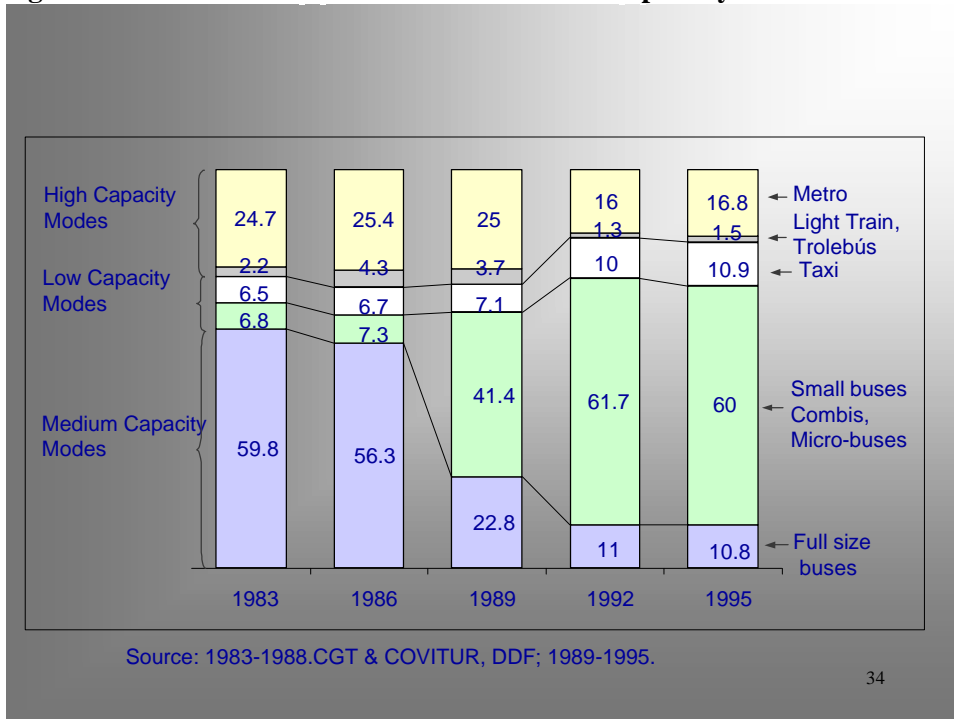
iv) Gradual carbonization (increase of greenhouse gas emissions per passenger-km) of the transport sector: need for a modal shift to reduce emission of criteria pollutants and greenhouse gases

The energy and greenhouse gas inventories for the MCMA indicate a gradual increase in its energy intensity. This finding is evident in the analysis of the modal evolution in the public transport system in the MCMA during the period 1983-1995 (**Fig. 3**) which shows that both the metro system and the bus have lost share of the total public transport market, having been displaced by smaller vehicles. The gradual shift away from large capacity vehicles is, in part, an unintended effect of the atomization of services in the

transport sector and the relatively poor regulatory system. This is an unwelcome development, especially in such a congested and polluted region as the Mexico City Metropolitan Area, where it has generated inefficiencies from a transport and environment perspective by adding to traffic congestion and reducing public transport productivity. It has resulted in higher emissions and exposure to criteria pollutants (and associated health impacts), caused increased releases of greenhouse gases, and has been linked to increasing accident rates. Finally, it has contributed to the inability of the rail mass transit system (essentially the metro) to attract passengers to its installed infrastructure. The Mexican authorities want to reverse this trend and promote measures that will aid the modal shift from small vehicles to large buses¹⁰ and the metro.

However, shifting passengers from private cars to public transportation facilities – or convincing new car owners to continue using public transportation -- is not an easy task. Bus and metro riding¹¹ is often uncomfortable and has an unattractive image with many residents of the MCMA, as evidenced by the declining metro ridership over the last decade. Lack of parking places at metro stations, and particularly the lack of efficient links between bus and metro routes pose additional difficulties, while the extension of the metro lines is very expensive and would not provide for full coverage of the needs in the MCMA.

Fig 3. Evolution of Modal Share in the Public Transport System of the MCMA



2.2 Government Strategy

Transport Sector Strategy in the MCMA

The Government of the DF has a "Programa Integral Para el Sector Transporte, which calls for: a) gradual elimination of subsidies to the transport sector and restructuring of the fare system; b) integration of the transport system with the State of Mexico and promotion of modal shift through the development of

corridors integrated to the metro system; c) strengthening of the public transport system, also through the development and implementation of transport corridors; d) reduction in the environmental load of the transport sector into the MCMA air shed; and e) support to technology improvements in the transport sector through the introduction of better bus and rail technologies.

The first objective supports the **development of a sustainable business environment** for the public transport sector. The authorities have started the reduction of subsidies in real terms but these still represent an important fraction of total operation costs for the bus and metro operations. On the other hand, the Government receives substantial income from taxes on fuel consumption, resources that are not fully allocated to the transport sector.

The **control of emissions by the transport sector** into the air shed of the MCMA has been initiated through adoption of more stringent emission and vehicle standards and through the definition of measures that would promote the integration of urban development plans and transport plans. However, these plans are still in the early phase of development. Measures to control the number of vehicles in areas of high congestion and traffic management measures to alleviate gridlock and the creation of pedestrian zones in downtown areas are also being considered.

Also the government intends to promote the introduction of low emission vehicles and promote a higher level of utilization of the metro. A study to restructure the system of bus route concessions was completed in 1999 but its recommendations have not yet been implemented for a lack of resources.

Promotion of a modal shift is a central part of the government's strategy. The key measure under consideration is the development of transport corridors on which high capacity, low polluting vehicles would operate. These corridors are being conceived as measures that would make more efficient use of infrastructure and move passengers in an integrated mode with the metro at higher speeds, lower costs per passenger and lower emissions per passenger kilometer and, at the same time, alleviate traffic congestion. The modal shift is expected to contribute to a reduction in the emission of greenhouse gases per passenger kilometer.

A key element in the promotion of the modal shift will be the intended introduction of **low emission, low carbon emitting vehicles**. This is being achieved through attracting ridership to the metro and the light train line (LRT), and through plans for the introduction of novel bus technologies. New-technology buses may also be specified for the busway corridors, but first there is a need to obtain solid information on which to base the decision.

Environment Sector: Formulation of a long term, multi-sector, strategic framework

The air quality management plan (2002-2010) consists of a multi-sector, metropolitan, long-term effort to address air quality issues in the MCMA and constitutes the official government strategy for air quality in the metropolitan area. The plan recognizes the pivotal role that the transport sector can provide in solving the air quality issues and identifies 47 out of a total 108 measures as linking transport sector and improvements in air quality. A key measure identified in the plan is the adoption of transport corridors as a means to promote a modal shift. The thrust of the effort is very clear: "to improve health indicators through reductions in exposure of populations to airborne pollutants".

The plan which has been issued jointly by the Government of Mexico City, the Government of the Estado de Mexico and the Federal Government summarizes prior work on air quality management and provides

an updated description of the situation in the Valley in terms of air quality. It concludes that while significant progress has been made, there are major challenges facing the goal of improved air quality. These are linked to the expected continuous growth in demand for services and economic activity and the difficult nature of the many dispersed sources of pollution in the area. Transport sector is identified as a key sector for immediate action. The plan also summarizes information available on the impacts on health from air pollution (drawing from the reports prepared with Bank and GEF PDF-B assistance).

The plan updates the emissions inventory (also prepared with Bank assistance) and establishes goals for the 10 year duration of the program. These goals are provided in quantitative form and summarized are:

- A substantial reduction in ozone concentrations and exposure (eliminating any concentrations above 200 IMECA points) and reducing average concentrations significantly;
- Reduce the concentration of PM10 and 2.5;
- Eliminate violations to the norm on CO concentrations;
- Reduce average concentrations of SO2.

To achieve these goals, the plan establishes a 10 year program consisting of 108 measures. Key parts of the program are:

- Reductions of emissions generated by the transport sector;
- Reduction of emissions from industry and service;
- Conservation of natural resources and forest cover in the Metropolitan Area;
- Integration of policies and plans in air quality, transport and urban planning;
- Reduction of exposures to high concentrations of pollutants;
- Promotion of environmental education and awareness and technology development;
- Harmonization of plans to address air quality and control de emissions of greenhouse gases.

3. Sector issues to be addressed by the project and strategic choices:

3.1 Sector Issues to be addressed by the project

The project would address the major sector issues in the following manner:

- The need for a **better harmonization of sector policies** on the issue of air quality and climate change will be addressed through the harmonization of current sector plans and support to the development and implementation of a climate action plan.
- **Lack of a sustainable business environment for public transport** will be addressed through the support to studies and measures to strengthen the sustainability of the public transport sector, including the adoption of business practices, organizational measures and incentives that would promote the transport corridors. A number of measures are being considered that would facilitate the modal shift from small vehicles to larger, energy efficient, low polluting vehicles and transport systems, with the ultimate goal of increasing the share in passenger transport of efficient, low polluting means of transport. This modal shift would result in a less carbon-intensive transport system and is intended to divert passengers from small inefficient vehicles toward the metro and full-size buses.
- **The Large contribution of the transport sector to the problem of air quality** will be addressed in the long term through measures that will enable a significant modal shift as discussed in the previous point. The intended modal shift will also contribute to address the gradual carbonization of the sector through the intended reduction in carbon emission intensity **as well as promote a more efficient (less congested) system** along the proposed corridors.

- **Global need for a comparative field test of low-carbon emitting vehicles.** While these efforts are underway, there is a need to field test the types of advanced vehicles that could be used as a complementary measure to the modal shift, to capture gains in greenhouse gas emission reductions. An alternative is the hybrid system which allows for improved combustion efficiency¹² in particular when heavy traffic is present, as is the case in urban environments. In this context, OP-11 emphasizes location as well as technology. The MCMA, given its size, location and character of its air pollution problem, constitutes a prime candidate to assess and promote the commercial viability of cleaner transport systems. Complemented with long-term modal shifts to public transportation, the global climate impacts could be significant. The GEF funding would support the incremental costs associated with a comparative field test of bus technologies, which could be used to substantiate relative advantages and emission performances, under real traffic situations in a large metropolitan area.

Table 2. Alternative bus technologies (see Annex 10).

Technology-Based Strategy	Capital Cost	Total Cost	% CO2 Equivalent Reduction	Cost (\$/ton) of Carbon Equivalent Reductions	Relative Impact on local criteria pollutants
LPG Vehicles	Low	Minimal to negative due to lower fuel cost	~ At least 15% for gasoline and diesel replacement	Minimal to negative for diesel and gasoline	Moderate
Natural Gas Vehicles	Conversion-\$1500 to \$4000; New-20-40% higher than diesel buses	Minimal to negative due to lower fuel cost (gasoline); high for diesel	~15%-20% for gasoline replacement; ~0 for diesel replacement	Minimal to negative for gasoline; high for diesel	Zero emissions of non-methane HC or PM10
Hybrid Electric Vehicles	~50%-150% higher than Diesel at low volumes; may be equivalent costs once in commercial production	Operating costs should be lower, total costs may be comparable to Diesel	At least 15%; potentially higher (30%) depending on driving cycles	Good at present to potentially very good	Lower emissions of PM10, VOCs and NOx
Fuel Cells (*)	1000% or more than diesel	High	Modest at present; could exceed 70-80% in future depending on source of H2	Very high at present to potentially very good in future	Zero for the vehicles
Diesel	low	low	Baseline	low	Baseline

(*) Field test of Fuel Cell buses is not supported by this project.

The information regarding Table 2 comes from the final report produced by the State and Territorial Air Pollution Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO), titled "Reducing Greenhouse Gases and Air Pollution. A Menu of Harmonized Options", of October 1999.

3.2 Strategic Choices.

- **Implementation of modal shift versus investing in additional thoroughways.** The project assists the development of the concept of public transport corridors as a tool to improve the efficiency of existing infrastructure (modified to conform to the corridor concept) as opposed to the continuation of the current trends (with gradual gains in the use of low capacity vehicles). This choice is at the root of a vision of development for metropolitan area, that places emphasis on people instead of vehicles.
- **Transport corridors versus expansion of metro.** The project also supports the concept of expansion of the reach of the metro system instead of its actual physical expansion, through integrated corridors as this choice is anticipated to cost about one tenth of the equivalent, were the metro system be expanded.

C. Project Description Summary

1. Project components (see Annex 1):

The project consists of six components:

a) Harmonization of sector strategies on air quality issues and Integrated Climate Action Plan for Transport (CAP) in the MCMA (\$0.8 million with a \$0.4 million GEF grant).

This component will support efforts to: a) facilitate the process of integration of strategies between the air quality (the air quality management plan), urban plan (land use plan) and transport sector plan in order to facilitate the adoption of harmonized policies on the air quality area; b) assess urban development models as linked to the process of air quality management; and c) assist in the development, evaluation and monitoring of the Mexico City Climate Action Plan as it relates to the transport sector. It is anticipated the plan will be adopted under the project by the end of PY1. The project will finance consultancy studies and equipment.

b) Definition of an enabling environment to facilitate the implementation of sustainable transport strategies (\$4.8 million with a \$2.9 million GEF grant).

The key project activity will focus on the promotion of measures that will facilitate a modal shift in the transport sector of the Metropolitan area (from one based on an increasing share of small, gasoline-based vehicles to a system based on high capacity, fuel efficient and low carbon emitting vehicles, running along transport corridors and linked and integrated with the Metro system).

To this effect, the project will focus on the adoption of an enabling policy and regulatory environment that will permit the development of transport corridors, as a key element of the modal shift. Transport corridors are expected to lead to a more efficient, less polluting public transport sector. The project will support a review of management and business organization measures that may be required to promote the adoption, design and use of corridor infrastructure, including a system of business organization, the concessions for specific bus line operations and the structuring of integrated fares. The component will also fund technical assistance to identify, improve and facilitate the adoption of economic incentives and regulatory system reforms required to overcome barriers to adoption of high capacity and non-motorized transport. This component will support the reform of public transport regulations for the proposed corridors. In addition, an institutional framework for the corridors including the integration with the metro will be defined and measures to promote metro rider-ship will be identified. This component will also finance an assessment of organizational measures proposed by the Mexico City Authorities to improve air quality and public transport efficiency. The studies will have a metropolitan character and would be commissioned after endorsement by the SMA, SETRAVI and the Secretary of Communications and Transport of the State of Mexico.

This component will also support an action plan for non-motorized transport. The objective of this action plan is to promote the use of bicycles as a mode of transport and aims at diverting commuters from motorized modes, especially private cars. Emphasis would be placed on campaigns to (a) expand bicycle use by improving its image and explaining its advantages, (b) raise traffic safety awareness, and (c) provide incentives to schools, employers, building managers, car park operators, and the Metro to provide bicycle parking on their premises. The program will be designed based on the large body of experiences (Europe, Bogota, Santiago, others) and literature to ensure that the resources available will be used as effectively as

possible. An estimate of the potential impacts on GHG emissions associated with the concept of the corridors is included as Annex 11 (Global environmental benefits).

The project will finance consultancy services and technical assistance. The outputs of this component will facilitate the adoption of measures required to implement the corridors which would be funded under the proposed Second Air Quality and Transport Project. The outputs however are important even if the loan does not materialize.

c) Field Test of Climate-Friendly High Capacity Vehicles (\$4.8 million with a GEF grant of \$1.6 million).

This component will support a comparative pilot (field test) for alternative bus and fuel technologies (hybrid and CNG) and modern diesel vehicles to test the comparative and absolute technical, economic, and environmental viability and climate advantages under typical operations in the MCMA. The testing vehicles will operate on a route, chosen to represent the average conditions of the metropolitan area, in terms of supply, demand, physical and topographic characteristics, and service providers. The buses will be operating on normal conditions, and their emissions would be regularly measured under a scientifically designed and statistically representative test protocol (the test protocol, including sample size, will be designed during project preparation by IMP with assistance from MIT, University of West Virginia and the Institute for Transportation Studies at the University of Berkeley).

Mexico city is an appropriate venue for this test given: i) the magnitude of the air quality problem; ii) the just completed comprehensive air quality management plan; iii) the availability of a modeling tool, focused on the characteristics of the metropolitan area to simulate and evaluate impacts of the proposed measures; iv) the presence of bus manufacturers; and v) available data on local and greenhouse gas emissions (inventories) that provide the current baseline. In particular, the test results will greatly benefit from the availability of the Multiscale Climate and Chemistry Model, recently adopted by the metropolitan authorities to simulate the impact on air quality and human exposures to specific air quality measures, developed during the assistance to the formulation of the air quality management plan. The project will partially fund the incremental cost of the vehicles and the cost of the testing and monitoring protocols.

The field test will enable decision making on use of alternative bus technologies. In this respect it is similar to the GEF funded fuel cell test. The test is connected to other components in that it complements regulatory and institutional activities that would enable the development of corridors with the examination of alternative buses to be used in the corridors, to reduce GHG emissions in the transport system. The field tests will yield data on emissions information for the different types of buses and will be used by STE. Also provide data on bus operation and maintenance. These will be useful to compare with the operating costs from other bus field tests in other cities (New York, Santiago and Copenhagen). The results will help people around the world assess how different technologies might fit into their cities long term bus fleet planning.

Clean technologies are adopted when they offer a high benefit (emissions reduction) to cost ratio. Calculating a carbon offset cost (in dollars per ton) requires knowledge of the operating costs per mile (along with other fixed costs), which can only be measured through the long term field testing of the vehicle in real world (revenue) operation. Measuring these costs are essential to comparing the cost effectiveness of these technologies and to helping other cities estimate their own environmental cost-benefits.

This field test will consist of real time measurement of the following parameters: a) emissions (local and

global) resulting from current and anticipated driving cycles; b) real operating costs; c) fuel efficiency per type of vehicles, and other indicators of sustainable transport (Annex 9). The results of this test will be of value to other high altitude cities, such as Bogota and Quito in the region. The test protocol will be ready by CEO endorsement.

d) Technical assistance and training for incorporation of climate change and air quality considerations in the design and analysis of transport strategies (US\$0.8 million; funded with a US\$0.4 million GEF grant).

This component will finance technical assistance and capacity building in order to incorporate climate and environmental considerations in the design of transport projects. Technical assistance, capacity building and training will be provided in the following aspects:

- a) Review and support to the restructuring of legal functions for SETRAVI as related to transport planning;
- b) Cost-benefit analysis using inter-alia, the data produced by the field test and including considerations of infrastructure costs and local and global environmental impacts, using the data produced by the field test (component c);
- c) Measurement of emissions from bus transport; including training to bus operators, mechanics, and maintenance staff; and
- d) Implementation of regulations.

e) Public Awareness and Dissemination (\$0.3 million, \$0.3 million GEF grant).

This component will support the design of a public campaign with respect to the impacts of sustainable transport strategies on climate change, other environmental and health impacts, outlining the advantages and objectives of transport corridors as well as benefits from the use of high capacity vehicles and non-motorized modes of transport. This component will also support the dissemination of technical information produced by the project and will promote and finance workshops and stakeholder meetings.

f) Project Management (\$ 0.7 million, \$0.2 million GEF grant).

This component will support the management of the project activities, including monitoring and evaluation. The project will finance management costs in the form of consultancy services and travel. The implementation agency will be the Secretary of Environment of the Mexico City Government (Secretaría del Medio Ambiente del Gobierno del Distrito Federal).

Component		Indicative Costs (US\$M)	% of Total	Bank financing (US\$M)	% of Bank financing	GEF financing (US\$M)	% of GEF financing
Harmonization of sector strategies and Integrated Climate Action Plan (CAP) for the MCMA		0.80	6.6	0.00	0.0	0.40	6.9
Enabling environment to facilitate the implementation of sustainable transport strategies		4.80	39.3	0.00	0.0	2.90	50.0
Field Test of Climate-Friendly High Capacity Vehicles and action plan for non-motorized		4.80	39.3	0.00	0.0	1.60	27.6

transport							
Incorporation of climate change and air quality considerations in the design and analysis of transport strategies		0.80	6.6	0.00	0.0	0.40	6.9
Public Awareness and Dissemination		0.30	2.5	0.00	0.0	0.30	5.2
Project Management		0.70	5.7	0.00	0.0	0.20	3.4
Total Project Costs		12.20	100.0	0.00	0.0	5.80	100.0
		0.00	0.0	0.00	0.0	0.00	0.0
Total Financing Required		12.20	100.0	0.00	0.0	5.80	100.0

Replicability

The proposed project has a significant replication potential. Specifically, Mexico City will be the first Latin American city establishing a Climate Action Plan and has in that sense a pioneer and exemplary function which can be replicated, especially in cities with comparable problems of pollution caused by an inefficient transport system. The replication strategy would be based on:

i) Several Latin American cities are interested in urban transport reforms along the lines in Bogota. The Mexico Project will provide a practical example on how to reduce pollution, address climate change and improve accessibility and sustainability to the transport system..

ii) Component B will lay the basis for a sustainable transport strategy focusing on structural reforms of public transport supply. Modal shift to large capacity vehicles is an objective of various medium and large size cities which also face the problem of an increasing amount of private cars. The size of Mexico City and the dimension of the transport problem gives it a special status and would find replication in megacities through the world, especially the integration of high-capacity busways and bus services feeding into existing rail systems.

iii) The successful adoption of an action plan for non-motorized transport allows further replication, once the barriers are identified and incentives established. It will provide a very strong example due to the fact that a consciousness concerning non-motorized transport is missing at the moment. It will be possible to introduce it more easily in cities of smaller size. A successful field test will provide information on less polluting, climate friendly transport alternatives on which decisions on alternative transport can be based. The provision of the resulting information by the field test to other Latin American cities will make this kind of test feasible in other cities facing similar issues and conditions. Moreover, the altitude of Mexico City influencing the field test is comparable to some other Latin American cities such as Bogota and La Paz.

iv) The completion of technical assistance, capacity building and training activities will lead to the incorporation of climate and environmental considerations in the design of transport projects and to the support of the field test of climate friendly transport systems. As these technical and training aspects are necessary once a city wants to introduce or strengthen environmental considerations in its transport system, the completion of this component will provide guiding assistance towards this objective.

v) The successful design of a public campaign and of dissemination of related technical information will lead in the long term to an increased use of high capacity vehicles, non-motorized modes of transport as well as increased public awareness of transport corridors and climate friendly technologies. This component will demonstrate how to disseminate these kind of information and how to increase the public awareness in a city of the size and with the conditions of Mexico City. In that sense it will provide guiding assistance for cities facing the same issues and which find themselves at the beginning of their environmental engagement.

Monitoring and Evaluation (M&E)

The metropolitan character of traffic-generated pollution requires a coordinated monitoring approach which is currently hampered by institutional fragmentation. The intersecretarial group that includes the SMA, SETRAVI, STE and the State of Mexico Authorities will provide a wider forum for coordination and communication between the different project activities and will have responsibility for their monitoring and evaluation. Specific M&E activities are outlined in Annex 1. Reporting on the indicators of each component will be monitored by the World Bank through Supervision missions and by the involved agencies through Project Progress Reports.

Monitoring and evaluation of the field test will cover the costs of operation, including fuel and other consumables, labor, maintenance and repair, as well as the measuring of pollutant emissions of each vehicle at various points during the testing period. An exact documentation of each step will be prepared. Finally an assessment will be made of the challenges to operating larger fleets of vehicles of these advanced types in Mexico City.

The test protocol will present its results in two parts: the field tests and the laboratory tests. Logs will be kept for each vehicle to monitor its economic and environmental performance. By entering them into a computer, statistics on emissions, costs etc. will be calculated and presented.

In the laboratory test the emissions of each bus will be tested in order to measure the expected benefits of alternative fueled vehicles in form of lower pollutant emissions. The results will be reported in emissions rate (grams per km) and can be compared from bus to bus and, in general terms, to buses in other countries and from different tests. The directors of the laboratory will oversee the testing and report all relevant results to the bus study managers who should coordinate laboratory tests with field operations. It is recommended that the fuels used during the field operations and laboratory tests should be monitored and tested for their actual chemical composition.

Incremental Cost

The concept of the incremental cost derives from the fact that, in order to maintain global sustainability, additional national action beyond what is required for national development is needed. Such additional action imposes additional (or “incremental”) costs on countries beyond the costs that are strictly necessary for achieving their own development goals, but nevertheless generates additional benefits that the world as a whole can share. To calculate incremental cost, the expenditure of the GEF activity and the cost saving on activities that, as a result of the GEF activity, will no longer be needed, must be estimated. The latter refers to the “baseline” of future activities for sustainable national development that does not explicitly take global considerations into account and that occurs in the absence of the project.

The proposed GEF Project assumes as a baseline scenario a business as usual operation of the transport sector without consideration for transport corridors. The considered baseline includes also the already completed Sector Work as a background to the purchase and operation of diesel buses. The Sector work was also a basis for the development of Air Quality Management in the MCMA (AQM-III:2000-2010). The total costs of the baseline amount to US \$ 4.3 million.

The proposed GEF project is complementary to the baseline scenario in that it will reduce GHG emissions along with local emissions. With exception of the already completed Sector Work and the purchase and operation of diesel buses the project is incremental. The following activities wouldn't be carried out without

the project, at least in the short run, which makes them additional (“incremental”): (i) Climate Action Plan; (ii) Definition of an enabling environment to facilitate the implementation of sustainable transport strategies; (iii) Field Test of Climate Friendly High Capacity vehicles; (iv) Technical Assistance and training for incorporation of climate change and air quality considerations in the design and analysis of transport strategies; (v) Public Awareness and Dissemination and finally the (vi) Management of the project.

The GEF alternative would entail costs estimated at US \$ 12.20 million. The resulting incremental cost (by subtracting the costs of the baseline from the costs of the alternative) amount to US \$ 7.9 million. The required GEF funding is US\$ 5.8 million.

2. Key policy and institutional reforms to be sought:

a) *Integration of planning strategies.* The project seeks a commitment to initiate the process of integration of strategies through an identification of common issues, gaps and the discussion of multi-sector approaches as a basis to develop harmonized strategies and a coordinated climate action plan.

b) *Consolidation and rationalization of bus services.* The Secretary of Transport (SETRAVI), with the assistance of COMETRAVI has committed to promote the consolidation and rationalization of bus services in the DF. This is a long-term goal that will have lasting impacts on the sector. To this effect, the SETRAVI has proposed and the Assembly has approved, the new Transport Law for the DF (1999). The main objectives of the Law are: a) to improve governance in the provision of bus services; b) to strengthen and better define the legal instruments that regulate service providers and users; and c) better apply existing regulations. The Law is now being regulated and its completion is not linked and escapes the scope of the proposed project. However, the SETRAVI has committed to take steps that will improve the consolidation and rationalization of the bus service in the City.

Discussions are being held with the SETRAVI to take the following steps in this direction:

- a) Maintain coordination between the transport authorities of the city and the State to review all aspects of the eventual integration of services for the MCMA;
- b) Implement the resolutions governing the phasing-out of the old and obsolete fleet, including the gradual retirement of the microbus fleet from service;
- c) Gradually privatize emission testing requirements for the STE fleet;
- d) Address corruption issues through the modernization and professionalization of the inspection system;
- e) Complete the studies to review the tariff system at STE;
- f) Identify management and business environment measures that would promote the professionalization of the public transport services (see policy matrix).

c) *Aid the modal shift from private cars to public passenger transport.* During project preparation, discussions are being held with the Transport Authorities, to design and initiate implementation of key measures in support of the long-term modal shift to favor the public transport system (bus-metro). Measures that would be initiated include:

- a) Identification of an enabling regulatory and institutional framework (policy environment) that would facilitate the adoption of transport corridors integrated with metro lines (component b of the project). See policy matrix below;
- b) Review of measures to further restrict cars in the downtown area;
- c) Improved enforcement of emissions testing;

- d) Development of a parking regulation including the parking pricing;
- e) Identification of traffic-demand management measures;
- f) Identification of a long-term land-use planning for densification, mixed use, and transit-oriented development.

Under item f) above, the City authorities are developing plans to arrest the expansion of the urban area in the Distrito Federal through densification plans.

Specific time-bound plans for adoption of these measures, in addition to the timetable included in the regulatory reform matrix, would be defined during project preparation and their implementation will be further pursued as part of the studies sponsored under the project and the preparation activities for the proposed loan. SETRAVI will sign a policy letter, prior to Board approval of the GEF project, confirming the specific actions it will undertake with regard to the actions listed under b) and c) above.

Policy Matrix for GEF project

Issue	Action needed	Impact	Timing in the GEF project cycle
Regional character of corridors and coordination of GDF and EDOMEX	Recognition of the metropolitan nature of the proposed corridors and their integration with the metro, to be confirmed in policy letter	Highlights the metropolitan character of the project and assists the coordination of actions by both administrations (State and City)	Signing of policy letter prior to CEO endorsement
Lack of a sustainable business environment for public transport	Identification of measures to facilitate modal shift	Modal shift	By Py03
Lack of an institutional framework to manage the corridors	Preparation of an institutional framework for the operation of corridors	Economic and financial viability of the corridors is strengthened, as well as their attractiveness to the traveling public	Signing of policy letter prior to CEO endorsement, the details of the organizational reform will result from the study of options financed by the GEF project
Fare structure does not meet efficiently criteria. Integrated fare for corridors (bus-metro)	Identification of a fare structure for metro and bus operators of the corridors	Efficiency gains achieved by the organizational reform in the corridors may obviate the need for fare increases. This will strengthen the case for replication in the MCMA	Signing of policy letter prior to CEO endorsement, the actual fare structure would result from the fare study, financed through the GEF project
The current business structure of bus operations is grossly inefficient and results in an unsafe and unattractive public transport system.	Enactment of bidding criteria for bus operation in the corridors Integration of small operators into professionally managed consortiums	Provides incentives for more professional bus operations Generates economies of scale	The key bidding criteria for participation in the corridors will be included in the policy letter signed prior to CEO endorsement The actual bidding process will be formally agreed

			prior to Board approval of the loan
Identification of corridors	Identification of best, most replicable corridors to maximize impact of system	Ensures replicability of pilot efforts	Prior to CEO endorsement
Social and environmental impacts	Action plan to address any potential environmental and social issues associated with the corridors to be built under the loan	Will ensure environmental and social sustainability	Criteria will be described in the policy letter signed prior to CEO endorsement. Adoption of detailed Action Plan prior to Board approval of the loan

3. Benefits and target population:

Benefits

The project is intended to yield the following benefits:

- An improved and more coordinated approach in addressing climate change issues associated to transport and air quality management through a Climate Action Plan;
- Adoption of organizational and barrier removal measures to facilitate the implementation of sustainable, climate-friendly transport strategies;
- A comparative field test that demonstrates less polluting, climate friendly transport alternatives. The data from the field test will be used for decision making on alternative transport. The associated measures of the field test will be institutionally, technically and financially feasible in other Latin American cities;
- MCMA transport projects incorporate climate change issues in design and operation;
- Increased use of high capacity vehicles, non-motorized modes of transport as well as increased public awareness of the advantages of transport corridors and climate friendly technologies;
- Effective project management of climate friendly transport projects.

Target Population

The actions promoted through the project would ultimately benefit the population of the MCMA by contributing to the harmonization and implementation of policies that result in direct reduction in exposure to criteria pollutants through the reduction of airborne pollutants and reduction in the emission of greenhouse gases. When implemented at a commercial scale, the emissions reductions and improvement of air quality will result in improvements in health indicators that will benefit the population at large and the most vulnerable groups (children and the elderly).

Coordination with other implementing agencies

The proposed project is being coordinated with similar projects under development in Santiago and Lima, through the World Bank and with the GEF-funded (under UNDP), Strategy for Development of Fuel Cell Buses for the developing world. UNDP, New York, 2001. While there are substantial differences between the proposed project and the UNDP executed project, both include a bus test of new technologies and need to be coordinated. This is being done through the STE, which is also the executing agency for the UNDP project.

4. Institutional and implementation arrangements:

Executing Agency

The executing agency is the SMA. An intersecretarial group has been created between the SMA and other agencies (SETRAVI, STE and State of Mexico authorities) to assist in the coordination of activities. The CAM will provide a wider forum for coordination and communication between the different project agencies.

Private sector participation will cover the cost of the buses, maintenance and fuel for the field test. These commitments are being formalized. The Center for Sustainable Transport will contribute to the cost of the studies and project management.

The testing activities will be undertaken by the IMP, technical support for the design of the testing protocols would be provided by the University of West Virginia, which has ample experience on the subject, having participated in the pilot project for hybrid vehicles in New York City, MIT and the Institute of Transportation Studies of the University of California at Berkeley. The dissemination activities will be undertaken in cooperation with the Commission of Environmental Cooperation (CEC).

The proposals here included are part of the Air Quality Management Plan and the Transport Sector Plan.

Progress to Date in Project Preparation

The objectives to be achieved by the project have been identified as priorities in the Air Quality Management Program for MCMA (AQM-III) (2002-2010), the Integral Transport Program (2002-2006), the General Urban Development Program (2002-2006) and finally the Environmental Program (2002-2006).

SMA, SETRAVI and STE, which have been involved from the beginning in the process of preparing and supervising the implementation of the PDF-B studies, have expressed their commitment to allocate enough resources in the next fiscal year to ensure the funding of the project baseline. The Grant will be channelled through BANOBRAS, which in turn will, under the terms of a subsidiary agreement, pass on the resources to the SMA.

The project preparation is being done by SMA, SETRAVI and STE. Results of the relevant studies funded through a PDF-B grant and a PHRD grant have been integrated into the project design. The federal government has applied for the PHRD grant to be executed directly by the World Bank and the GEF grant being managed by BANOBRAS.

The PDF-B supported two types of studies:

- a) assessment of the global nature of the air quality issues in the MCMA; and
- b) assessment of specific alternatives to address the emission of GHG.

Under the global assessment, the PDF-B supported an energy balance for the MCMA; a GHG inventory; an assessment of energy intensity of economic activity. All these studies were instrumental in defining the project: the energy inventory identified the transport sector as the key user of fuels in the MCMA, and

identified type of fuels used. The GHG inventory led to the quantification of GHG by each economic activity, identifying the volume and type of GHG released by the transport sector and confirming its character as key source of GHG. The energy intensity study revealed the increase in carbonization of the transport sector.

Under the specific activities studies, the PDF-B revealed the barriers that faced modernization of the transport sector and the introduction of new technologies. For the activities under the energy rubric (solar water heaters, energy efficiency) the studies revealed that these measures are economically competitive today and that barriers impeding further progress are related to those common to introduction of new measures (perception of risks, lack of information). Still, the authorities have decided to focus on the transport sector which is by far the largest contributor of GHG as the studies have confirmed and where a modal shift has the largest potential for significant reductions.

The Shell Foundation through the World Resources Institute and the Center for Sustainable Transport have confirmed their technical and financial assistance and their support to facilitate private sector participation. In addition, the project has the support of the federal government (see annex 7).

D. Project Rationale

1. Project alternatives considered and reasons for rejection:

An alternative considered but not pursued consisted of the GEF project being a component of the proposed loan. This was not a viable alternative on account of the need for the GEF funded studies to take place well before the loan could be processed. The GEF-funded studies facilitate the review of options to enable the environment conducive to the adoption of the proposed transport corridors. Without this phasing, it would not be possible to pursue the corridors option at the time the loan would be in place.

Bus technologies considered for inclusion in the test, involved many options. However, at the end only the Diesel, CNG and Hybrid options were considered because: a) diesel constitutes the baseline (option that would be in place without GEF funding); b) CNG constitutes an option with strong political approval and some field experience; c) hybrid-diesel constitutes a robust option in terms of potential reductions in emissions of greenhouse gases. Options discarded included: a) LPG because of decisions to control fugitive emissions from LPG in the MCMA.

There are different approaches for reductions in GHG emissions from the transport sector such as: reducing fuel usage per passenger-vehicle, shifting to lower-carbon energy sources, shift people to lower-emitting modes and to reduce travel altogether. The proposed project supports measures and policies to promote a modal shift in the transport sector of the Metropolitan area (from one based on an increasing share of small, gasoline-based vehicles to a system based on high capacity, fuel efficient and low carbon emitting vehicles, running along transport corridors and linked and integrated with the Metro system).

However, to make these gains possible, it is necessary to ensure that an enabling environment is adopted (climate friendly policies and measures as part of the sector policies). First, the project seeks the integration of urban planning, air quality management and sustainable transport planning strategies into the development, evaluation and monitoring of a Climate Action Plan for the MCMA. Second, the project aims at facilitating the implementation of sustainable transport strategies (i.e. corridors) through the definition of economic incentives, the improvement of the regulatory system and finally the support of the

removal of barriers and organizational measures. Third, from a global perspective there is a need to provide field data on the new vehicles and compare it with performance information for baseline alternatives. The project fills this need through the undertaking of a comparative field test between the hybrid vehicle, CNG and modern diesel buses. Fourth, the project provides technical assistance, capacity building and training to incorporate climate and environmental considerations in the design of transport projects and to support the mentioned field test. Finally, a public campaign will be designed outlining the advantages and objectives of transport corridors as well as the benefits from the use of high capacity vehicles and non-motorized modes of transport and the related technical information will be disseminated.

2. Major related projects financed by the Bank and/or other development agencies (completed, ongoing and planned).

Sector Issue	Project	Latest Supervision (PSR) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
Bank-financed			
Environmental protection and natural resource management, strengthening institutional and policy framework	Mexico Environmental Project	S	S
Environmental investments, strengthening institutional capacity on the state and municipal level	Mexico Northern Border	S	S
Conservation and natural resource management of protected areas	Mexico Protected Areas (GEF)		
Regulatory framework and institutional strengthening	Mexico Air Quality I	S	S
Strengthening institutional, technical, administrative and regulatory capacity and improving solid waste services	Mexico Solid Waste Management II	S	S
Municipal infrastructure and capacity building	Mexico Water and Sanitation II	S	S
Small scale municipal infrastructure, institutional strengthening	Mexico Decentralization & Rural Development (DRD II)	S	S
Institutional Strengthening	Mexico: PROMAD		
Environmental Sustainable transport	Santiago's Air Quality and Transport Project (Chile)		
Urban transport and institutional strengthening	Bogota Urban Transport Project		
Urban transport and institutional strengthening	Lima Urban Transport		
Other development agencies			
United Nations Development Program UNDP-GEF	Demonstration Project of Hydrogen Fuel Cell Buses and an Associated System for Hydrogen Supply in Mexico City		
Inter-American Development Bank	Water supply and Management		

(IDB)	in ZMVM (in preparation)		
Inter-American Development Bank	Water and Sanitation in Rural		
(IDB)	Areas (in preparation)		
German Cooperation (GTZ)	Decentralization of Solid Waste		
	in Mexico DF		
German Cooperation (GTZ)	Industrial Waste and Hazardous		
	Waste in Mexico DF		
German Cooperation (GTZ)	Environmental Technology for		
	Small-sized Industry		
German Cooperation (GTZ)	Air Quality Mexico DF		
Japan OECF	Water supply and Sewerage in		
	Guadalajara		
Japan OECF	Mexico DF Sanitation Project		
Japan OECF	Mexico City Sulfur dioxide		
	Emission Reduction		

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

3. Lessons learned and reflected in proposed project design:

The Bank has a long-standing involvement in the sector of Air Quality Management. The first project in the MCMA was approved in 1992. The objective of this project (just closed) was to support a comprehensive program to reduce transport generated air pollution in the MCMA. This project was followed by the provision of technical assistance in the formulation of the AQM-III. The implementation of the First Quality project offers a valuable experience on which to base the proposed GEF-funded operation. The project was satisfactorily completed and an ICR has been issued. Some of the lessons learned during its implementation, that have been incorporated in the project design, include:

Air pollution is a long-term problem that requires a long-term response

The Mexican Government has recognized the need for a long term strategy to address the issues caused by air pollution (PICCA and PROAIRE) and accordingly has committed to the development of long range plans, the first of which covered a 5 year period in the DF. To assist in this program, the World Bank needs to continue to have a long-term commitment that matches the time requirements needed to secure sizable and permanent improvements in air quality. A long-term vision and concomitant goals need to be set, to guide removal of barriers and promote short-term measures.

Planning for the long-term, however, requires flexibility

Previous experience has shown that, despite the best planning efforts in the preparatory stage, required adjustments in air quality management activities will only become evident during their implementation.

Wide participatory approach to air quality management

A participatory approach, incorporating public opinion in the project, is required to establish legitimacy of the project. Widespread implementation of the proposed measures is also critical in order to achieve the desired results. To accomplish this, it is necessary to gain public confidence and support for the program activities. There is also a need to build consensus among all stakeholders over the identification of priority measures. The effectiveness in carrying out and monitoring the agreed priority measures needs to be determined in a participatory approach, with the input of all stakeholders. Commitment from the Mexican government to publish environmental audits annually to promote the achievements of the clean air programs, as well as to improve institutional transparency is vital. Such audits could help promote

local ownership and full support from the highest levels of Government.

The Bank's involvement should continue to be used for its catalytic effect

The World Bank should continue to catalyze the involvement and the participation of development banks and agencies, the private sector, NGO's and foundations and research and training centers. The Bank should work to mobilize technical and financial support from international environmental agencies and to organize study tours to cities with experience in modern transport strategies. The project will support a dissemination effort of the results and experiences obtained through the implementation of its components.

Local air management matters from a global perspective

Local air pollution issues and global concerns are linked. Local programs may contribute to global benefits.

4. Indications of borrower and recipient commitment and ownership:

SMA and STE helped identify the project at the beginning of 1999, and has actively participated in the preparation and supervision of the on-going preparatory study, funded by a GEF PDF-B grant. SETRAVI, the city executive agency in charge of transport, has stated its interest and high level of priority attached to the project. The federal, state and city authorities under CAM support the project and have requested the Bank to advance with the project proposal to be submitted to GEF at its next Council Meeting. The project document has been drafted with the participation and clearance of the SMA, SETRAVI and STE and the log frame was developed during a two day session with all the implementing agencies. The project is part of the Air Quality Management Plan and the Transport Sector Plan.

5. Value added of Bank and Global support in this project:

Test: The Bank involvement brings a global experience with air pollution and transport issues and its linkage with global concerns. The policy dialogue with the environmental authorities banks on extensive expertise at the Bank on the subject. The involvement of the Bank/GEF in the proposed project provides an opportunity to support a critical effort by the Government of Mexico to i) improve the environmental performance of the transport sector, ii) improve global environmental quality through the reduction of greenhouse gases; and, iii) partly reduce dependence on high-carbon fuel-generated energy. Bank involvement has made possible the sharing of its broad experience in air quality and transport and adapting it to Mexican conditions. GEF involvement is critical to catalyzing local willingness to test and demonstrate hybrid bus technology.

E. Issues Requiring Special Attention

1. Economic

☒ Summarize issues below ☐ To be defined ☐ None

Economic evaluation methodology:

- ☐ Cost benefit
- ☐ Cost effectiveness
- ☒ Incremental Cost
- ☐ Other (specify)

For the incremental costs of the project see Annex 4

2. Financial

☐ Summarize issues below ☐ To be defined ☒ None

As the project focuses on studies and policy reforms to remove barriers for instituting a modal shift and provide better information for decision making, most of the financial analysis will be done as part of the project. This will include a financial analysis of options for a business structure for the integration of the bus corridors including factors such as the system of business organization, the concessions for specific bus line operations and the structuring of integrated fares. In addition, a financial analysis will be done to determine the viability of the different bus technology options in light of the operational performance and cost information provided by the field test.

3. Technical

☐ Summarize issues below ☐ To be defined ☐ None

- Corridors: The selection of the corridors will be done as part of project preparation and before board approval. The design of the selected corridors will be done as part of project preparation for the proposed loan, under a PHRD grant. It will be timed so as to allow the activities of the GEF project to be coordinated with the design.
- Field Test: As part of project preparation the protocol for the field test will be prepared. Among the issues to be addressed are: *Fleet size:* A statistical assessment was performed, estimating that it would take 3-4 buses per technology option to provide a robust test that can be used for decision making. This will be confirmed during preparation. *Testing protocols:* The protocols for testing the emissions and monitoring the operational performance will be determined as part of the feasibility studies. These will be completed in consultation with the private sector parties involved in the field test.

4. Institutional

4.1 Executing agencies:

Secretaria de Medio Ambiente (SMA) under terms of a subsidiary agreement with BANOBRAS.

4.2 Project management:

4.3 Procurement issues:

4.4 Financial management issues:

None

5. Environmental

5.1 Summarize significant environmental issues and objectives and identify key stakeholders. If the issues are still to be determined, describe current or planned efforts to do so.

The project will focus on climate change-related policy and regulatory reform and the development of a climate action plan. In addition, there will be a comparative field test of buses. The field test will involve established routes, will not require any new works and therefore will not involve resettlement and the only environmental issues are related to standard maintenance of the vehicles, such as disposal of waste oil. Therefore no safeguard policies are triggered. In order to ensure that the environmental benefits of the project are maximized in the short and long term, the policy reform and field test, including the chosen routes for the field test and transport corridors, will be based on an extensive characterization of the airshed of the Mexico City Metropolitan Area and assessment of environmental impact of transport policy options done under the WB environment sector work.

5.2 Environmental category and justification/rationale for category rating: **C - Not Required**

5.3 For Category A and B projects, timeline and status of EA

EA start-up date:

Date of first EA draft:

Expected date of final draft:

5.4 Determine whether an environmental management plan (EMP) will be required and its overall scope, relationship to the legal documents, and implementation responsibilities. For Category B projects for IDA funding, determine whether a separate EA report is required. What institutional arrangements are proposed for developing and handling the EMP?

Not required.

5.5 How will stakeholders be consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed EMP?

5.6 Are mechanisms being considered to monitor and measure the impact of the project on the environment? Will the indicators reflect the objectives and results of the EMP section of the EA?

Yes. The Test Protocol will be the indicator.

6. Social

6.1 Summarize key social issues arising out of project objectives, and the project's planned social development outcomes. If the issues are still to be determined, describe current or planned efforts to do so.

6.2 Participatory Approach: How will key stakeholders participate in the project?

During project preparation and as part of the activities sponsored through the PDF-B, the Government organized a transport group with participation of transport companies, users, vehicle and fuel manufacturers as well as regulatory agencies and transport and environment institutions. The output of these consultations were fed into the processing of the AQM-III and resulted in the formulation of transport priorities under the Air Quality Management Plan. A key priority identified by the transport working group and later validated by the CAM was the suggested transport corridors. In addition, the transport companies have played an important role in the formulation of the project, they are being consulted regarding the development of a business model for the operation of the corridors and they will participate actively in the review of the results. These agencies and groups have participated in discussions leading to the conceptualization of the project.

The Center for Sustainable Transport constitutes a highly visible opportunity for further involvement of stakeholders in Mexico. The CST will be launched on April 16 with participation of key stakeholders in air quality management, climate change and transport.

Other important stakeholders, such as the secretaries of finance, technical and planning agencies, citizen groups and others will be engaged through meetings and discussions during preparation of the project. A project advisory committee will be constituted to provide an overview and quality control during project preparation, representing all key stakeholders.

The institutional stakeholders: SETRAVI, STE, COMETRAVI are part of the Inter-secretarial committee and will thus help monitor and assess the implementation of project activities. Bus manufacturers will

participate as co-financiers of the field test by providing the vehicles that will be tested.

The transport operators and users are being consulted in each action taken for development of the corridors. A public awareness campaign is being developed through the Center for Sustainable Transport. Transport operators and bus manufacturers have been contacted and are part of the consultations strategy for implementation of the corridors. Through the Inter-secretrail committee, the different institutional stakeholders as well as the transport operators and users will be consulted. Their views will be considered and incorporated during project implementation.

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

See Annex 7

6.4 What institutional arrangements are planned to ensure the project achieves its social development outcomes?

6.5 What mechanisms are proposed to monitor and measure project performance in terms of social development outcomes? If unknown at this stage, please indicate TBD.

TBD

7. Safeguard Policies

7.1 Do any of the following safeguard policies apply to the project?

Policy	Applicability
Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Natural Habitats (OP 4.04, BP 4.04, GP 4.04)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Forestry (OP 4.36, GP 4.36)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Pest Management (OP 4.09)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Cultural Property (OPN 11.03)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Indigenous Peoples (OD 4.20)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Involuntary Resettlement (OP/BP 4.12)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Safety of Dams (OP 4.37, BP 4.37)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD
Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)*	<input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> TBD

7.2 Project Compliance

(a) Describe provisions made by the project to ensure compliance with safeguard policies which are applicable.

(b) If application is still to be determined, describe current or planned efforts to make a determination.

8. Business Policies

8.1 Check applicable items:

- ☐ _ Financing of recurrent costs (OMS 10.02)
- ☐ _ Cost sharing above country 3-yr average (OP 6.30, BP 6.30, GP 6.30)
- ☐ _ Retroactive financing above normal limit (OP 12.10, BP 12.10, GP 12.10)
- ☐ _ Financial management (OP 10.02, BP 10.02)
- ☐ _ Involvement of NGOs (GP 14.70)

8.2 For business policies checked above, describe issue(s) involved.

F. Sustainability and Risks

1. Sustainability:

Successful adoption of an integrated Climate Action Plan for the transport sector, harmonized with Air Quality, Transport and Urban Plans facilitates the sustainability of the climate change agenda in the MCMA in the long-term and commits agencies involved in the Climate Action Plan after the project. Successful adoption of organizational and barrier removal measures facilitates the implementation of sustainable, climate-friendly transport strategies and creates a sustainable institutional and technical framework. Successful field test demonstrates less polluting, climate friendly transport alternatives and makes it feasible to provide this information to other Latin American cities. Completion of technical assistance, capacity building and training activities leads to incorporation of climate and environmental considerations in the design of transport projects and to support of the field test of climate friendly transport systems. Successful design of public campaign and of dissemination of related technical information leads to increased use of high capacity vehicles, non-motorized modes of transport as well as increased public awareness of transport corridors and climate friendly technologies. The strong commitment from State and City Authorities and the integral character of the proposals as part of the Air Quality Management Plan provide the required wide support to ensure sustainability.

While the development of an enabling environment for the adoption of transport corridors and promotion of a modal shift is a very local issue (depending on local conditions), the process to be followed will be of interest to other large metropolitan areas. In this context, the project has a value added. Also, the test for the alternative bus technologies will be designed and implemented in a manner that will allow for wide-use of the information.

2. Critical Risks (reflecting the failure of critical assumptions found in the fourth column of Annex 1):

In addition to the risks outlined in the table below, there is a risk that the loan that would support the actual construction of the corridors may not materialize. Still, even if the loan does not materialize, the modal shift intended requires the removal of barriers as a sine qua non condition. This is the objective of the GEF project. The proposed public transport corridors themselves are likely to be implemented with or without Bank involvement, if all barriers are removed (The corridors in Bogota took place without a Bank loan only when the barriers were removed).

Mexico City is financially capable of investing in an infrastructure project of this magnitude, they could do this without the future involvement of the Bank. There will be however a written commitment to borrow from the Bank to support the infrastructure required for the corridors. A Bank loan will facilitate the implementation of the corridors and actions to initiate the design have already started, sponsored by the Bank through a PHRD grant and counterpart resources. There is a strong commitment to implement the corridors and these have been incorporated as part of the key measures to be implemented under the current administrations (the corridors make part of the transport and environmental plans).

The environmental metropolitan authorities (State and City), as well as the federal government (SEMARNAT and the Health Secretary) enforced their commitment on the implementation of corridors in the Third Air Quality Management Program in the MCMA (AQM-III 2002-2010). In addition, the Transport secretariat strongly manifested its interest in the strategic corridors, within the framework of the Integral Transport Plan (2002 – 2006). All these have been developed in a coordinated manner by the

agencies involved.

The AQM – III indicates that the implementation of public transport corridors aim to promote a modal shift to high capacity vehicles by facilitating the integration of new busways with the metro system. A typical corridor project includes three components: a) at least one busway and the restructuring of road-based public transport in the corridor; b) the upgrading of transfer terminal(s) between metro and bus; and c) improvements to the metro line. The intended benefits include shorter travel times for passengers, better performance and reduced operating costs of public transport providers; and less pollution – to be achieved through increasing metro use, the re-structuring of road-based public transport, and improved administrative and legal arrangements.

Both programs, guarantee that the corridors establishment of the GEF project will be followed up by the competent authorities.

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
1.- Political support for Climate Action Plan	M	Sector work has focused on development of an integrated plan. Under the project, technical assistance and policy dialogue will be continued.
2.- Institutional commitment to framework	S	Key measures have been identified under the Air Quality Plan. Plan has been endorsed by key stakeholders in government.
3.- Field test results have political and public acceptance	M	Protocols and technical assistance. Participation of IMP, MIT, U of Berkeley and UWV will reduce risks of failure.
4.- Availability of supporting technical infrastructure	M	The involved sectors have been engaged in the design of the project. The private sector has expressed its interest to participate.
5.- Public acceptance of promoted measures	S	Through a Dissemination Plan and a public campaign design, the stakeholders are going to be informed of the technical information and the project progress report.
Provisions of technical information of the project		
Loan does not materialize	M	The removal of barriers is the critical step for implementation of the corridors. Alternative financing may be sought if the loan does not materialize.
From Components to Outputs		
Cooperation of involved agencies and availability of counterpart funds	M	Sector and technical agencies have indicated their willingness to participate.
Willingness of private sector to participate	M	The private sector has expressed support for the project.
Effective project management	N	The involved agencies have expressed their commitment to work in coordination.
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N(Negligible or Low Risk)

G. Project Preparation and Processing

1. Has a project preparation plan been agreed with the borrower (see Annex 2 to this form)?

☐ Yes - date submitted: ☒ No - date expected: 05/01/2002

2. Advice/consultation outside country department:

- ☐ Within the Bank:
☐ Other development agencies:
☐ External Review

3. Composition of Task Team (see Annex 2):

4. Quality Assurance Arrangements (see Annex 2):

5. Management Decisions:

Issue	Action/Decision	Responsibility

Total Preparation Budget: (US\$000) **Bank Budget:** **Trust Fund:**

Cost to Date: (US\$000)

☐ **GO** ☐ **NO GO**

Further Review [Expected Date]

Walter Vergara
Team Leader

John Redwood
Sector Director

Olivier Lafourcade
Country Manager

Annex 1: Project Design Summary

MEXICO: Introduction of Climate Friendly measures in Transport

Hierarchy of Objectives	Key Performance Indicators	Data Collection Strategy	Critical Assumptions
Sector-related CAS Goal: Environmental agenda: Promotion of institutional development, decentralization of environmental management, mainstreaming of global issues, climate change.	Sector Indicators: -Improved capacity of local and national institutions. -Increase in number of environmental projects initiated by local institutions. -Increase in number of government policies that incorporate climate change issues.	Sector/ country reports: Sector Work (World Bank) Sector Work (World Bank) Sector Work (World Bank)	(from Goal to Bank Mission) Macroeconomic stability Political acceptance

<p>GEF Operational Program: OP 11 Promoting environmentally sustainable transport Specific objective: reduce GHG emissions from urban and surface transport sources in recipient countries by facilitating recipient countries' commitment to adopt sustainable low-GHG transport measures, and disengagement from unsustainable measures common in many parts of the world.</p>	<ul style="list-style-type: none"> - Identification of low-GHG transport measures - Improved sustainability of the transport sector 	<p>Transport sector reports</p> <p>Greenhouse gas emission inventories</p>	<p>Government remains committed to promoting the adoption of low-GHG emitting transport options.</p>
<p>Global Objective:</p> <p>Project Development Objective: The project development objective is to contribute to the adoption of policies and measures that will assist in a long-term modal shift to climate-friendly, more efficient and less polluting, less carbon intensive transport in the MCMA.</p>	<p>Outcome / Impact Indicators:</p> <p>Comp. 1. Harmonized cross-sectoral plan of action. Adoption and initiation of Climate Action Plan and associated measures by the end of PY2</p> <p>Comp. 2. Identification of organizational and barrier removal measures (enabling environment) to facilitate the implementation of sustainable, climate friendly transport strategies by the end of PY2</p> <p>Comp. 3. Field test demonstrates less polluting, climate friendly transport alternatives; Decisions made on alternative transport based on data from field tests by the end of PY2</p>	<p>Project reports:</p> <p>1. Supervision Reports, Agency Reports by Key agencies, Project Progress Report. Plan of Action and Climate Action Plan</p> <p>2. Project Progress Reports (SETRAVI)</p> <p>3. MCMA Transport Project Reports (STE), Project Progress Report, Supervision Report, Evaluation Report</p>	<p>(from Objective to Goal)</p> <p>Commitments of agencies involved in CAP continue after the project</p> <p>Sustainability of institutional and technical framework</p> <p>Continuity of incorporation of climate change issues into transport projects</p> <p>Continuity of public awareness campaign and dissemination</p> <p>Climate friendly measures for transport sector are institutionally, technically and financially feasible in other Latin American cities</p> <p>Measures lead to modal shift to low GHG emitting transport</p>

	<p>Comp. 4. MCMA transport projects incorporate climate change issues in design and operation by the end of PY3</p> <p>Comp. 5. Better understanding of the potential of high capacity vehicles, non-motorized modes of transport as well as increased public awareness of the advantages of transport corridors and climate friendly technologies by the end of PY5</p> <p>Comp. 6. Effective Public management by the end of PY2</p>	<p>4. Supervision Report, Project Progress Report (SETRAVI/SMA)</p> <p>5. Supervision Report, Project Progress Report and Public Awareness Survey</p>	
<p>Output from each Component:</p> <p>Component 1: -Harmonization of sector strategies on air quality issues and Integrated Climate Action Plan (CAP) for the MCMA</p> <p>Component 2: Definition of an enabling environment to facilitate the</p>	<p>Output Indicators:</p> <p>1. Review report on Air Quality, Urban and Transport Plan including gaps and overlaps analysis completed by the end of PY1</p> <p>2. Calibration of urban development models linked to the process of transport and air quality planning completed by the end of PY2</p> <p>3. Climate Action Plan completed by the end of PY1 and be updated routinely during the duration of the project</p> <p>1. Definition of an institutional framework for the corridors including</p>	<p>Project reports:</p> <p>-Review report on Air Quality, Urban and Transport Plan including gaps and overlaps analysis</p> <p>- Climate Action Plan</p> <p>-Institutional Framework</p> <p>- Business structure report</p>	<p>(from Outputs to Objective)</p> <p>Political support for CAP</p> <p>Institutional commitment to framework</p>

implementation of sustainable transport strategies	<p>integration with the metro by the end of PY1</p> <p>2. Initiation of a reform of bus regulations in the corridors by the end of PY1</p> <p>3. Definition of business and management structure for operating the bus corridors by the end of PY1</p> <p>4. Identification of measures to promote metro rider-ship by the end PY1</p> <p>5. Action Plan for non-motorized transport</p>	<p>- Report on metro rider-ship promotion measures</p> <p>- Plan of Action</p>	
Component 3: Field Test of Climate-Friendly high capacity vehicles	<p>1. Protocol Manual by the end of PY1</p> <p>2. Field test produces statistically robust results that can be used for decision making by end of PY3</p>	-Protocol manual	Field test results have political and public acceptance
Component 4: Incorporation of climate change and air quality considerations in the design and analysis of transport strategies	<p>1. Completion of legal review for SETRAVI by the end of PY1</p> <p>2. Perform analyses of benefits, costs (additionalities), environmental impacts and climate impact assessments of sustainable transport project completed by the end of PY2</p> <p>3. New project management procedures to ensure monitoring, evaluation and reporting on GEF benefits developed and adopted by the end of PY2</p> <p>4. Planning protocols to allow state of the art vehicle technologies and non-motorized transport measures to be incorporated in the development of projects and programs developed and adopted by the end of PY2</p> <p>5. Development of methodologies for</p>	<p>- Project supervision Report</p> <p>- Project Progress Report</p>	Availability of supporting technical infrastructure

	<p>measurement and verifications of emissions from public ground transport by the end of PY2</p> <p>6. Training to bus operators, mechanics, and maintenance staff to ensure that the testing vehicles are well operated and maintained completed by the end of PY2</p> <p>7. Development of standards and regulations to support climate and environmental considerations in transport projects by the end of PY2</p> <p>8. Training and support for contracting and coordinating market studies and surveys completed by the end of PY2</p> <p>9. Training in the form of workshops to transfer knowledge about testing procedures, operation and maintenance protocols and its potential of tested technologies for mitigating climate change and reduce air pollution completed by the end of PY2</p>		
Component 5: Public awareness and dissemination	<p>1. Technical information produced by mid PY2</p> <p>2. Public Campaign designed by the end of PY2</p> <p>3. Dissemination Plan on the basis of the technical information produced by the project</p> <p>4. Promotion and Financing of workshops and stakeholder meetings by the end of the project</p>	<p>-Technical information material</p> <p>- Dissemination Plan</p> <p>- Public campaign design</p> <p>- Project Progress Report</p>	<p>Public acceptance of promoted measures</p> <p>Provision of technical information of the project</p>
Component 6: Project Management	<p>1. Project implementation unit in operation in the first quarter of PY1</p>	<p>-Supervision Reports</p> <p>-Project Progress Reports</p>	<p>Effective Project Management</p>

	<p>2. Completion of project activities</p> <p>3. Evaluation of results of the project by the end of the project</p>		
<p>Project Components / Sub-components:</p> <p>1.0: Integrated Climate Action Plan</p> <p>1.1: Harmonize Policies Plan for Air Quality, Transport and Urban Planning (Calibration of Urban Plans with Air Quality and Transport Plans)</p> <p>1.2: Climate Action Plan</p> <p>2.0: Definition of an enabling environment to facilitate the implementation of sustainable transport strategies</p> <p>2.1: Institutional framework including integration of metro and bus transport</p> <p>2.2: Reform of bus regulations in the corridors</p> <p>2.3: Business and managing structure for operating the bus corridors</p> <p>2.4: Measures to promote metro rider-ship</p> <p>2.5 Action Plan for non-motorized options</p> <p>3.0: Field test of Climate-Friendly High Capacity Vehicles</p> <p>3.1: Comparative Field Test for alternative bus and fuel technologies</p> <p>4.0: Technical assistance and training for</p>	<p>Inputs: (budget for each component)</p> <p>1.0: US\$ 0.8 million (with US\$ 0.4million GEF grant)</p> <p>1.1: US\$0.32</p> <p>1.2: US\$0.48</p> <p>2.0: US\$ 4.8 million (with US\$ 2.9 million GEF grant)</p> <p>2.1: US\$ 1.86 million</p> <p>2.2: US\$.56 million</p> <p>2.3: US\$ 1.6 million</p> <p>2.4: US\$.25 million</p> <p>2.5: US\$.53 million</p> <p>3.0: US\$ 4.8 million (with US\$ 1.4 million GEF grant)</p> <p>3.1: US\$ 4.8</p> <p>4.0: US\$ 0.8 million (with US\$ 0.4 million GEF grant)</p>	<p>Project reports:</p> <p>Progress, disbursement, audit and supervision reports</p>	<p>(from Components to Outputs)</p> <p>Cooperation of involved agencies</p> <p>Willingness of private sector to participate</p> <p>Availability of counterpart funds</p> <p>Effective project management</p>

incorporation of climate change and air quality considerations in the design and analysis of transport strategies			
5.0: Public Awareness and Dissemination	5.0: US\$ 0.3 million (GEF grant)		
5.1: Collection and integration of produced information by the project	5.1: US\$.07 million		
5.2: Design of public campaign outlining the advantages and objectives of transport corridors as well as the benefits from the use of high capacity vehicles and non-mototized modes of transport	5.2: US\$.05 million		
5.3: Dissemination of technical information produced by project	5.3: US\$.15 million		
5.4: Promotion and financing of workshops and stakeholder meeting	5.4: US\$.03 million		
6.0: Project Management	6.0 US\$ 0.7 million (with US\$ 0.2 million GEF grant)		
6.1: Implementation of the project	6.1: US\$0.15 million		
6.2: Operation of activities	6.2: US\$ 0.4 million		
6.3: Final evaluation	6.3: US\$ 0.15 million		

Annex 2: Project Preparation Plan
MEXICO: Introduction of Climate Friendly measures in Transport

A. Core Project Preparation Team

Name	Bank Unit	Borrower Agency	Role/Responsibility
Walter Vergara	LCSES		Task Manager
Juan Andres Lopez-Silva	LCSES		Energy and Environment Specialist
Carl-Heinz Mumme			Consultant/ Transport
Gerhard Menckhoff			Consultant /Transport
John Morton			Consultant / Environment
Seraphine Haeussling			Consultant
Alexandra Zenzen			Consultant
Claudia Sheinbaum		SMA	Minister
Silvia Blancas		SETRAVI	General Director
Florencia Serrania		STE	General Director
Mauricio Cuellar	FPSI		Transport Specialist
Aaron Goulb			Consultant

B. Project Preparation Activities

Key Outputs	Prepared by	Responsibility	Cost	Appraisal Requirement	Target Date
Feasibility Studies					
Test Protocol	Consultant	STE			
Environment Assessment					
Social Assessment					
Institutional Assessment					
Project Implementation Plan (PIP)	SMA	SMA			

C. Specialist Tasks

Specialist Area	Level of analysis /Tools	Skills Needed	Key Output Document	Bank Review Target Date

Annex 3: Project Processing Timetable
MEXICO: Introduction of Climate Friendly measures in Transport

Project ID: P059161		Key Dates	
Timetable step	Original	Plan	Actual
GEF Eligibility Confirmation	-	-	-
Concept Review	03-Mar-99	04-Mar-02	-
RVP/ROC/OC Signoff	-	-	-
PID to Infoshop	-	01-Apr-02	-
ISDS to Infoshop	-	-	-
PID Received by Infoshop	-	-	-
ISDS Received by Infoshop	-	-	-
GEF Council Approval	-	09-May-02	-
Decision Meeting	19-Mar-99	12-Aug-02	-
Auth Appr/Negs (in principle)	15-Jul-99	26-Aug-02	-
Updated PID to Infoshop	-	-	-
Updated ISDS to Infoshop	-	-	-
Updated PID Received by Infoshop	-	-	-
Updated ISDS Received by Infoshop	-	-	-
EA Received in Infoshop	-	-	-
Begin Appraisal	15-Jan-00	19-Aug-02	-
Send Notice/Issue Inv't Neg	-	-	-
Begin Negotiations	-	-	-
GEF CEO Endorsement	-	-	-
Board Approval	14-Mar-00	17-Sep-02	-

Annex 4

Incremental costs

Overview

The proposed GEF project seeks to contribute to the adoption of policies and measures that will assist in a long-term modal shift toward climate-friendly, more efficient and less polluting, less carbon intensive transport in the Mexico City Metropolitan Area (MCMA). Specifically, the project will support aspects of the implementation of the recently completed Air Quality Management Plan (2002-2010) which are consistent with the GEF operational program on sustainable transport (OP-11) and the Climate Action Plan for Mexico City.

Context and Broad Development Goals

The MCMA constitutes one of the three largest metropolitan areas in the world. It has 18 million inhabitants, equivalent to about 19% of the country's entire population, who are being exposed to high levels of ozone and particulate matter. The MCMA also produces more than a third of the national GDP and generates, in the process, several million tons of atmospheric pollutants.

Air pollution in MCMA is mostly due to: (i) a high concentration of ozone, produced by the reaction of volatile organic compounds and nitrogen oxides in the presence of the sunlight; (ii) carbon monoxide, nitrogen oxides, sulfur dioxide and hydrocarbons emitted by vehicles fueled with gasoline and diesel; (iii) sulfur dioxide emitted by industrial processes and commercial services using liquid industrial fuels; and (iv) particulate matter (PM) in the form of particles smaller than 10 microns (PM10) emitted by several sources using diesel and other fuels.

In reaction to the aforementioned problems the Mexican authorities have been working on air quality improvements for several years. They have reduced the emissions of lead, SO_x and CO. On the other hand, ozone concentrations have remained high, often exceeding acceptable levels. Particulate matter (PM) levels are also high along heavily congested zones and in areas under the direct influence of wind erosion and denuded land.

Early last year the Mexican authorities decided to continue this work, through the formulation, design and implementation of the next stage of Air Quality Management in the MCMA (AQM-III:2000-2010). Its development is based on World Bank sector work that includes studies on: (i) an emissions inventory; (ii) a health impacts study; (iii) study to harmonize measures to address local and GHG pollution; (iii) modeling of air quality and impact of courses of action; and (iv) assessment of the economic impact of courses of action.

As part of the program of Bank assistance, a Bank loan (Second Air Quality and Transport Project) is being prepared with the objective of reducing the pollution load from the transport sector, while improving the safety and efficiency of urban transport management at the metropolitan level. This will be sought through enhancement of the use of space-efficient and low-polluting transport modes, including the inter-modal shift from small to high capacity vehicles and strengthening the control of emissions from cargo transport. The GEF project will help lay the foundation for the implementation of the loan and also provide a link between the sector work and the work to be initiated through the loan.

Scope of the analysis

The analysis of physical investments is limited to the single pilot project in the MCMA where hybrid buses, CNG and large Diesel buses will be purchased, operated and their performance evaluated. The analysis of the integration of air quality management and transport planning strategies into a Climate Action Plan for the MCMA, economic incentives, regulatory system reforms, removal of barriers, technical assistance, capacity building, training and dissemination activities will focus on the situation in the MCMA in the context of the sector work already completed and the current GEF project.

Baseline Scenario

The baseline scenario assumes the continued investment and operation of diesel buses. The emphasis under the baseline would be on reducing local emissions in the most cost effective way, with little attention devoted to GHG that would be released. The baseline includes the Sector Work already completed as background to the ongoing work and the purchase and operation of diesel buses.

The results from implementing the baseline scenario would be positive. The main outcomes would be the reduction of local pollutants, provision of the bus service and provision of background studies to develop a plan to reduce air quality in MCMA. However, without the GEF project, GHG emissions abatement would not be a priority investment in the short term.

GEF Alternative

Due to the nature of Mexico's unbinding commitments under the FCCC and the Kyoto Protocol, the national efforts to mitigate the current emissions of GHG will be undertaken based on a gradual and voluntary participation of stakeholders, and supported by available international funding mechanisms to cover the associated incremental costs. As part of the strategies to mitigate climate change included in the National Communication, Mexico gives priority to the implementation of programs to improve air quality in the main four metropolitan and industrial areas. Measures concentrate in five principal areas: cleaner industry, non-polluting vehicles, efficient transportation, urban planning and environmental recovery. The project is fully consistent with these federal climate change strategies.

There are two main approaches for reductions in GHG from the transport sector: reducing fuel usage per passenger-vehicle and shifting to lower-carbon energy sources. The proposed project combines both by supporting measures and policies to promote the use of high capacity vehicles and non-motorized transport. In order to make these gains possible it is necessary to ensure that climate friendly policies and measures are seen as part of the sector policies.

The proposed project is complementary to the baseline scenario in that it will reduce GHG emissions along with local emissions and will lay the framework for similar benefits under the future WB loan. The total expenditures for the GEF alternative are estimated in the table below.

Global benefits

Global benefits will be achieved by the GEF project in form of (i) development of an plan for addressing climate change in the transport sector that is consistent with other MCMA plans; (ii) reduction in GHG emissions through the introduction of a fleet of low carbon emitting buses and encouragement of bicycle use; (iii) providing field performance data useful in assessing the best options for investment in low carbon emitting vehicles and enabling the institutional, technical and financial replication in other Latin American Cities; (iv) increased capacity, reduced barriers and provided incentives for facilitating the implementation of sustainable, climate friendly transport strategies in the future and for incorporating climate specific and environmental considerations in the design and analysis of transport options; and (v) increased public awareness and dissemination of the advantages of transport corridors and climate friendly technologies leading in the long run to an increased use of high capacity vehicles and non-motorized modes of transport;

Incremental Aspects of the GEF Project

The GEF Project is with exception of the already completed Sector Work and of the purchase and operation of diesel buses incremental.

1. Harmonization of Sector Plans and Climate Action Plan for Transport

The baseline for this component includes the already completed Sector Work. A Climate Action Plan wouldn't be adopted in the short run without the GEF Project which will be integrating plans on air quality, transport and urban development into a Climate Action Plan. The costs associated with this component are except for the Sector Work incremental.

2. Enabling environment for Sustainable Transport (Barrier Removal and Organizational Measures)

The associated baseline includes like in the first component only the Sector Work. This component wouldn't be carried out without the GEF project. It refers to facilitating the implementation of sustainable, climate friendly transport strategies with special focus on the preparation of the implementation of corridors. It also includes an action plan for non-motorized transport enabled through the project. The preparatory work for the corridors, which will be implemented through the Bank Loan, represents a mayor part of the GEF Project which makes the associated costs incremental except for the costs of the Sector Work.

3. Field Test

The field test for high capacity vehicles for the demonstration of less polluting, climate friendly transport alternatives are made possible through the project. The incremental costs of this component result from subtracting the costs of the baseline scenario, which is assumed as the purchase and operation of diesel buses and as occurring without the project, from the costs of the field test which includes -beside the costs of the field test and the associated training costs- the investment, maintenance and operation costs of diesel, CNG and hybrid buses whereas only the associated costs of hybrid buses are considered incremental.

4. Incorporation of climate and environmental considerations in the design and analysis of transport strategies

The costs for this component are abstracting from the Sector Work purely incremental as they refer mainly to sustainable transport projects enabled through the GEF project and further on through the Bank Loan. This component provides the technical assistance, the capacity building and the training required for

incorporating climate and environmental considerations in the design and analysis of transport options as well as for the support of field test only occurring through the GEF Project.

5. Public Awareness and Dissemination

The costs of this component are fully incremental due to the fact that the Public Awareness Campaign and the Dissemination are completely connected to the result and the objectives of the GEF project. The emphasis here is to promote the advantages and objectives of corridors as well as the benefits of high capacity and non-motorized transport. In addition, the technical information produced by the project will be disseminated and the continuity of public awareness will be supported through workshops and stakeholder meeting in order to deepen the awareness about the importance of sustainable transport. All these aspects are a result of the project. As this component wouldn't take place without the GEF project, it is considered incremental.

6. Project Management

Due to the fact that the Project Management relates fully to the GEF Project the associated costs are completely incremental. This component includes the implementation of the project, the operational integration of the activities and finally the evaluation of the project's results.

Incremental Cost of the GEF Project

The implementation of the Baseline scenario would entail costs estimated at US \$ 4.3 million, while the GEF alternative would incur costs estimated at US \$ 12.2 million. The additional costs associated with the implementation of project are estimated at US \$ 7.9 million. The GEF will fund US\$ 5.8 million of this as part of the project.

Incremental Cost Matrix (all figures in US\$ million)

Revenues from collection of fares were not considered as the revenues would be the same under the baseline and the alternative.

Cost Categories	Baseline Current situation	Alternative Enabling environment, removal of barriers and field test	Incremental Costs	Domestic Benefits	Global Benefits
1. Harmonization of Sector Plans & Climate Action Plan	0.4	0.8	0.4		Basis for action in transport sector
2. Enabling Environment (Barrier Removal and	1.5	4.8	3.3	Facilitate implementation of sustainable transport	Facilitate implementation of sustainable, climate friendly

Organizational Measures)					transport
3. Field Test	2.0	4.8	2.8		
Investment Costs of Buses	1.4	2.3	0.9	Reduction of local pollutants, fuel savings	Reduction of GHG emissions
Operation and Maintenance of Buses (NPV/5yrs/10%)	0.6	0.7	0.1	Buses can serve the needs of consumers and reduce local pollution as designed	Buses can reduce GHG emissions as designed
Training	0	0.3	0.3		
Field Testing	0	1.5	1.5	Field data for assessing best options for investments in low emitting vehicles and for replication in other cities	Field data for assessing best options for investments in low carbon emitting vehicles and for replication in other cities
4. Incorporation of climate and environmental considerations in the design and analysis of transport options	0.4	0.8	0.4		Form basis for expansion of program of low carbon emitting vehicles
5. Public Awareness and Dissemination	0	0.3	0.3	Increased public image of public transport	Increased awareness of role of transport in climate change. More political and public support for CC agenda
6. Project Management	0	0.7	0.7	Improved efficiency and managerial knowledge	Effective implementation of global climate change aspects of project
Total Costs	4.3	12.2	7.9		

Annex 5

Transmilenio Mass Transit System

While the proposed corridor transport concept for the MCMA is different to Transmilenio, the experience of the latter offers valuable lessons that are being considered in the design of the options in Mexico. This annex summarizes some of the key features of the Transmilenio experience.

Bogotá is one of the most densely populated cities in the world, with approximately 7 million people in an area of only 35,000 hectares. This has caused congestion on the main roadways where the average speed of traffic during rush hour is only 10 kilometers per hour. The use of private cars is a major cause of the congestion. Although approximately 71% of motorized trips are made by bus, 95% of road space is used by private cars that transport only 19% of the population.

Transmilenio, a mass transit system based on buses, is part of the strategy implemented to improve the congestion in the city by reducing reliance on private cars, and consists of the following main components: (i) infrastructure to improve traffic congestion under the responsibility of the public sector (exclusive lanes, stations and terminals, access ways, parking lots and maintenance shops); (ii) an efficient operating system (operation companies, buses and employees) run by the private sector; (iii) an effective and transparent fare collection system (equipment, card based and fiduciary management) run by the private sector; and (iv) a permanent public institution in charge of planning, operation and control.

Some features of the system are: (i) people are transported in articulated buses with a 160 passenger capacity; (ii) there are stations every 500 m with terminals and interchange stations at the end of each line so the passenger can continue his trip using feeder buses (40-80 passenger capacity) without paying an extra fare; (iii) each articulated bus has a GPS connected by satellite to a control center, where the frequency, position and speed is controlled; (iv) the payment for the use of the system is made upfront using a card system; and (v) the concessionaires for the operation include operators already providing bus services, and domestic and international investors while the feeder bus service is contracted out to existing transportation companies.

The first stage of the system, partially under operation, comprises 470 articulated buses, and 41 km of segregated busway. It is transporting 550,000 passengers and it is expected to transport 890,000 when all of the lines and terminals are under operation. The total cost of the first stage is US\$ 320 million. Stage II and III are proposed to expand the system to include 22 corridors that could meet the demand of about 85% of the trips made in Bogota.

Diagram of Stage I (thick line) and Proposed Stage II and III Corridors



After 10 months of operation, Transmilenio achievements include:

- Ridership has increased from 312 to 1807 passengers per day per bus;
- Commercial success: it is expected that the bus companies will recover their investment in the articulated buses within 4 years;
- No public subsidies: except for the initial infrastructure investment and road maintenance, all costs are financed from fare collection;
- Passenger benefits: the average travel time for a trip on the corridors has reduced 32%;
- Improved traffic safety: in the bus corridors, the weekly number of traffic accidents has declined from 26.5 to 4.9 in 2001, with injuries and fatalities falling from 18 to 4.5, and from 1.3 to 0.1 respectively;
- Pollution has reduced (SO₂, NO₂, O₃ and PM-10) significantly along the corridors;
- Excellent public image: In a recent survey (9/01), 88% of the respondents rated Transmilenio as either “good” or “very good”.

Transmilenio has created important changes in the transport sector:

- It has catalyzed the modernization of the public transport industry in Bogotá. The creation of solid operation companies and fleet owners, has made the provision of efficient and high quality service a priority;
- It has begun dismantling the “Guerra del centavo” (“street war”) that came about as a result of the traditional payment system to drivers based on the number of passengers moved per day;

- The concession contracts have made it mandatory to retire and destroy 2.7 old buses for each articulated bus purchased.

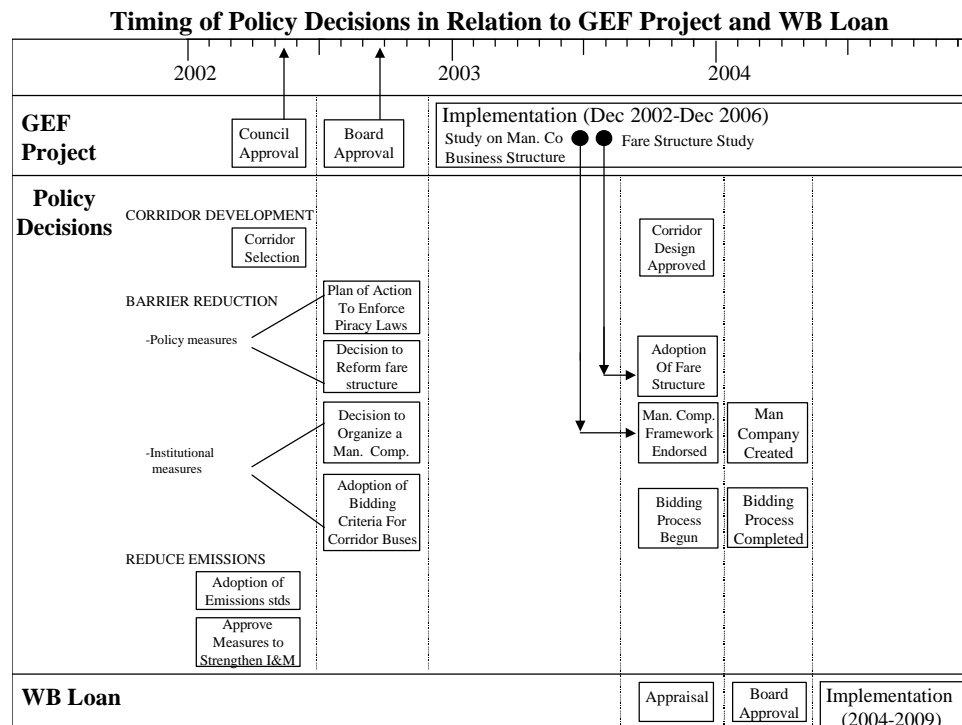
The key factors in successful project implementation have been:

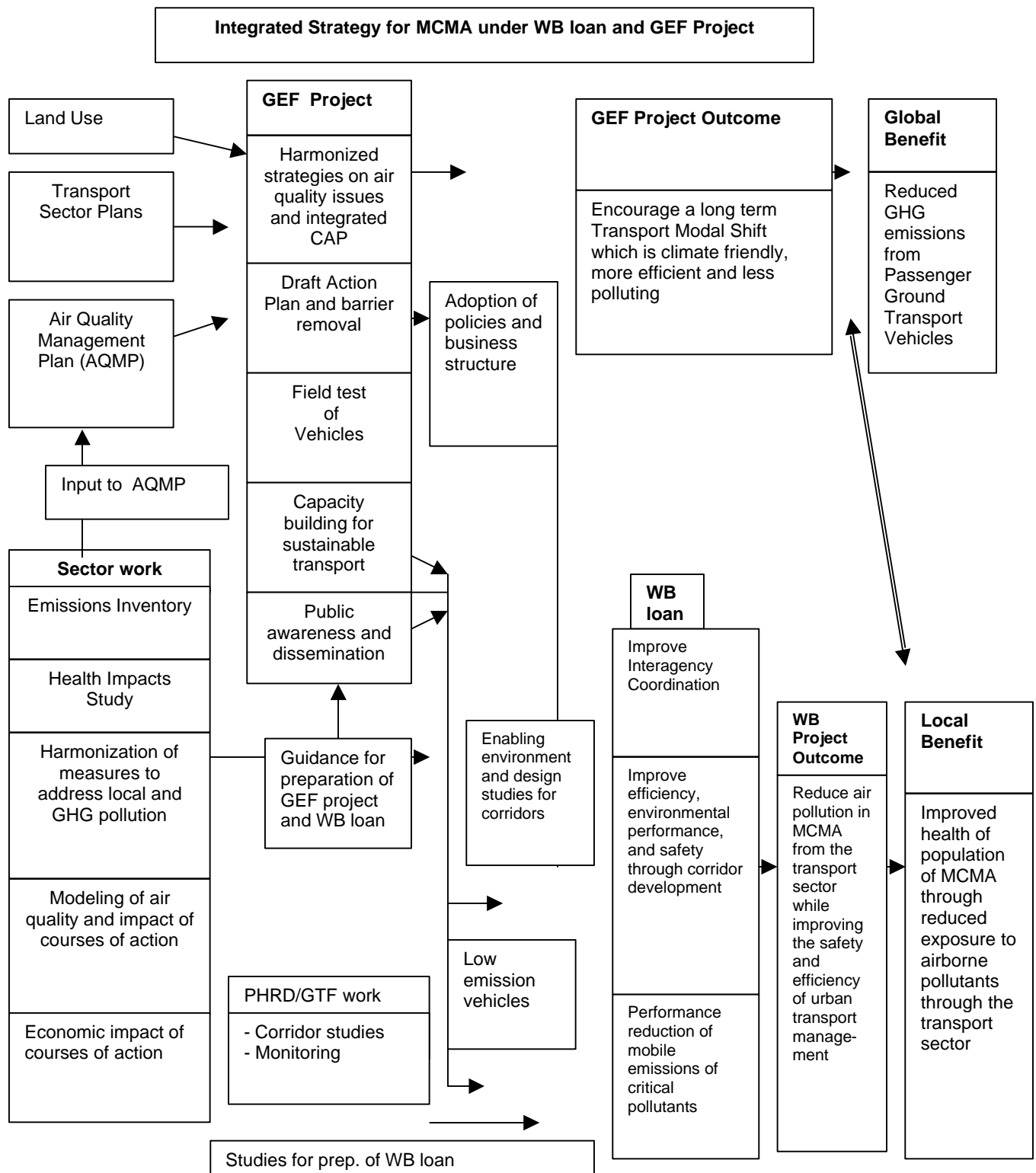
- The city had enough financial resources for the project from the sale of a portion of the Power Company; This allowed the project to be implemented effectively and before the end of the mayors term of office;
- The project execution was based on politically and financially realistic planning;
- A highly qualified management and technical team was engaged to develop the project;
- The team worked outside the day to day work of the public institutions to allow them to focus on the development and implementation of the project;
- There was a clear decision to work with the established private operators. The partnership with the private operators permitted a smooth transition into the implementation phase of the project;
- There were minimal negative impacts for the most powerful stakeholders (politicians, bus industry, operators).

The project had strong leadership, political will and institutions.

Annex 6

Timing and Integrated Strategy





Annex 7

Center for Sustainable Transport, Energy and Environment

The Shell Foundation and the World Resources Institute are delighted to announce that Mexico City has agreed to become the first and Lead Partner City for the Center for Sustainable Transport, Energy and Environment at the World Resources Institute. This formal cooperation will extend over a five-year period (2002-2006) and involve the joint commitment of resources and effort by the signatory parties to a "Program for Sustainable Transport in Mexico City". The mission of this "Project" is to foster the implementation of an environmentally sustainable urban transport system in Mexico City. Mexico City's commitment to this sustainable transport effort marks it as one of the more far-sighted city governments in the world, committed to delivering a better quality of life for its citizens.

Background. The Shell Foundation is a UK registered charity that was established in June 2000 by Royal Dutch/Shell. The mission of the Foundation is the promotion of sustainable development world-wide. It pursues this mission primarily via providing financial grants to support of projects carried out by established nonprofit organizations and focusing on the Foundation's three major areas of concern: the links between energy and poverty, particularly in developing countries, where some 2 billion people do not have access to modern energy; the impact of energy production and consumption on the local and global environment; the effect of globalization on the welfare and livelihood of marginalized and vulnerable communities.

The Foundation has a distinguished Board of Trustees that includes Mr Philip B. Watts, Chairman of Royal Dutch/Shell; Sir John Houghton, Co-Chair of the Inter-Governmental Panel on Climate Change and Prof Jose Goldemberg, University of Sao Paulo, Brazil and Minister for Environment, Sao Paulo State, Brazil. More details on the Foundation can be found on its website: <http://www.shellfoundation.org>

Under the auspices of its work on the environmental impacts of energy consumption, the Shell Foundation in December 2001 awarded the World Resources Institute in Washington DC a 5 year, \$3.75 million grant to establish a new Center for Sustainable Transport, Energy and the Environment.

WRI is one of the world's leading environmental NGOs and is highly respected by the international NGO, government, academic and industrial communities. More information about WRI can be found on its website: <http://www.WRI.org>. The director of the Center will be Dr. Lee Schipper, who brings 30 years of experience from working in literally dozens of countries of the South and North.

Transport is a key conduit of economic and social benefits. It is also a source of major environmental problems, both locally - via congestion, noise and air pollution affecting the health and economic fortunes of many millions of people - and because CO₂ emissions from transport in all regions of the world are rising more rapidly than total emissions making transport one of the single most important drivers of global climate change. There is a growing societal consensus that "something needs to be done" to tackle the transport/environment conundrum and a number of initiatives have been tried or are underway. Yet, of all the energy-related problems affecting the environment, transport has so far proved the most intractable.

The Shell Foundation, via the creation of Center at WRI will support a multi-year program of work that will tackle the transport-environment problems faced by large urban centers particularly in developing countries - where most future growth in transport and transport-related environmental problems will occur. The primary short-term goal of the new Center is the development of proven models of effective intervention introducing sustainable transport solutions in select target cities in the developing world. The

long-term goal is that these models of successful intervention will be subsequently deployed in other developing country cities with growing transport problems. The effort will focus on close partnerships with public and private authorities in the partner cities, with strategic alliances with private fuel and vehicle makers, multi- and bi-lateral lenders, academics, and NGOs. Information technology will strengthen these partnerships through meaningful exchange of data, experience, and good evaluation of policy and technology experiments.

Institutional Base and Project Objectives. The lead Mexico City institutions in the Program will be the Ministry of Environment (SMA), and the Ministry of Transport (SETRAVI). Other city authorities with a major role in transport such as STE - the Electric Bus Authority will also be involved in the work of the Project. The Project will give major support to the World Bank/Global Environmental Facility Program

Introduction of climate friendly transport policies and measures in the Mexico City Metropolitan Area.. The Project will work closely with international motor vehicle and fuel companies and regional and national authorities. CEIBA, a widely recognized NGO in Mexico, will act as Center's coordinator of the project.

The Mexico City Sustainable Transport Project will work at four, interrelated levels:

Analysis: The Program will deliver credible analysis of technical, economic, and policy aspects of providing environmentally and financially sustainable solutions to the problem of transport in Mexico City.

Advice and Information: The Program will make concrete policy and planning recommendations, and disseminate information relevant to the planning and decision-making of those actors in a position to make major investments. Web-based tools will provide a key means to this end, and other cities in Mexico will be invited to follow the developments in Mexico City.

Engagement: The Program will facilitate the engagement and commitment of private, civil society and public sector leaders in Mexico City to a mutually agreed plan to implement the new, sustainable transport policies and programs called for by the above analysis.

Implementation: The Program will support SMA's efforts to design, implement, and evaluate concrete interventions in land use and transportation, including those arising from the new World Bank/GEF project.

Further Details. The new Center at WRI and the Mexico City Program for Sustainable Transport will be formally launched in Mexico City in Spring 2002.

Annex 8

Cost of Field Test

Cost Estimates Matrix: Alternative Fuel Bus Evaluation Program

The program is estimated to cost between 3.25 and 3.72 million US dollars, excluding the costs of emissions testing which could add

Vehicle cost

	Diesel	CNG	Diesel-Hybrid
Fixed Costs:			
# Vehicles	4	4	4
\$/Vehicle (US)	80,000	90,000	200,000
Kms/dia/veh	220	220	220
dia/año	312	312	312
salary/driver	7,074	7,074	7,074
driver/veh	2.2	2.2	2.2
# years	2	2	2
Fueling Facilities (US)	0	400,000	50,000
SubTotal - Fixed	444,497	884,497	974,497
Variable Costs:			
# Vehicles	4	4	4
Fuel	.08-.13 \$/km	.07-.1 \$/km	.06-.9 \$/km
Maintenance (US)	.21-.27 \$/km	.25-.31 \$/km	.31-.36 \$/km
Cost/km (low)	0.29	0.32	0.37
Cost/km (high)	0.40	0.41	0.45
Veh-Kms/año	68,640	68,640	68,640
# años	2	2	2
SubTotal - Var (low)	159,245	175,718	203,174
SubTotal - Var (High)	219,648	225,139	247,104
Total :	603,742	1,060,215	1,177,671
	to	to	to
	664,145	1,109,636	1,221,601

Testing Program Costs

Engineering and Support 2 "Technical" FTE total for 2 years =100,000 (4 x 25000)

Vehicle Emissions Testing Costs Temporary Use of Equipment (West Virginia U), costs = 30,000 per bus

* 10 buses + 10,000 per day extra * 10 days per session

Permanent Testing Facility Construction (2-4 M depending on the extent of facility capabilities)

Total for 4 testing periods About US\$1.6 million

Total Cost: US\$4.8 million

Training Costs: 20,000

Total Program Cost Estimate: (excluding Vehicle Emissions Testing) about US\$3.2-3.5 million

Notes

driver/mechanic costs:	Technical FTE salary assumed = 25,000 per year	Driver FTE Salary: "overhead multiplier"	1.4
		months	12
		salary (pesos)	4000
		pesos/dollar	9.5
		FTE/year =	7073.68421

Maintenance = oil, parts, labor, tires, brake pads, repairs, with US. labor costs.

Training costs estimate = 20,000

Annex 9

Fleet Size for Bus Tests

Some of the goals of this project are to predict the maintenance and fuel costs and emissions characteristics of alternative fueled buses operating in the ZMVM. In order to make these predictions, a small test fleet will be assembled and tested in actual service conditions, undergoing detailed recording of fueling and maintenance as well as periodic emissions testing in a laboratory.

These parameters (costs, emissions, etc.) to be measured will differ from bus to bus, and the statistical significance of these differences is what will make the program's conclusions meaningful. That is, the difference in fuel economies between the CNG and Hybrid buses in the tests should be statistically significant for the results to be useful in predicting future differences. To provide significance, the test program needs to meet certain requirements.

The differences in measured parameters (cost, etc.) between buses will depend on two sources of variation. One, "between buses," results from the large differences in the engine technologies between the various "types" of buses (CNG, Hybrid, etc), as well as smaller variations due to random and unseen manufacturing differences and each vehicle's individual histories. The other source of variation affecting the parameters results from the aging of each bus (mileage) as it is used in service, and can be thought of as "within" each bus. For instance, for a particular bus, fuel economy can vary from day to day. This is variation "within" that particular bus. The relative sizes of these "between" and "within" variations are important to making statements about the differences between the bus types in the test fleet and predictions about the larger fleet this test fleet is representing.

First, it should be insured that the "within" variation is minimized. This will insure that differences "between" buses can be shown to be significant and not due to randomness. This "within" variation shrinks as bus mileage increases, and the more mileage each bus has, the stronger a statement can be made about its particular measurements.

Going still further, to make statistical arguments about the differences between one bus "type" and another (where several buses in the fleet are of the same type), the variation between buses of the same type (i.e. "within type") must be minimized. This variation falls as more vehicles of each type are added. That is, according to inferential statistics, the error of prediction, e , for some parameter falls as the number of samples rises:

$$e = [CV \cdot 1.96 / \sqrt{N}]$$

where CV is the standard deviation divided by the mean for the sample (or "coefficient of variation"), e , equals the error with which to predict the parameter, N , is the number of subjects in the sample, and 1.96 is the number of standard deviations needed to be 95% certain that the true parameter falls within the error specified.

Vehicles of the same type do not display very much variation amongst themselves because they are produced under very controlled and identical environments, and will be run under similar conditions. This means the CV is small and the number of vehicles, N , needed to predict a parameter for a larger population becomes small as well. Rearranging the previous equation:

$$N = [1.96 \cdot CV / e]^2$$

For a C.V. of 5%, and an allowable prediction error, e, of 5%, N equals 4 vehicles. Actually, this estimate of 5% in C.V. for some parameter, such as fuel economy, among vehicles of the same type (i.e. two buses of the same brand, model and age), seems high, and is probably a bit less, meaning even less vehicles are needed to be tested

Indeed, as few as two or three vehicles are regularly tested by the EPA to predict the emissions characteristics of hundreds of thousands of vehicles for a particular make and model. As well, there are many bus studies which use as few as one vehicle of each type to make comparisons between types.

Summarizing, in order for the measured parameters (costs, emissions, etc) to be statistically meaningful as representative of a larger sample, it is recommended that at least 3-4 vehicles of each type be included in the test fleet and that vehicle-kms be accrued to the maximum extent possible during the tests.

The gathering of maintenance records and fuel consumption data will occur daily, and emissions are taken at certain points during the test duration. Emissions characteristics change very slowly over a vehicle's life after the initial break-in period, so taking these measurements every few months or even as little as once per year would be sufficient and in accordance with numerous other studies of bus emissions.

General Protocol for Test of Climate Friendly Vehicles

Via the proposed field testing of alternative fueled vehicles, Mexico City will become an important laboratory for understanding the costs, benefits and challenges of operating advanced technologies in the world's largest mega-cities. The proposed testing protocol will involve procedures standard to bus testing around the world. The deliverables of the tests are 1.) measures of the costs of operation, including fuel and other consumables, labor, maintenance and repair, 2.) measures of the pollutant emissions of each vehicle at various points during the testing period and 3.) an understanding of the challenges to operating larger fleets of vehicles of these advanced types in Mexico City. The test protocol designed to achieve the desired outcomes will be presented in two parts: the field tests, and the laboratory tests.

The Field Tests

Much of the testing of the buses and operations will take place through field testing the bus in actual service conditions. The collection of information about maintenance and fuel costs can only come through the day to day operation of the buses.

The principal implement of the field tests are the Operations Reports. These reports are filled out for every single action done to a vehicle and include the following information:

Date
Time
Vehicle identifier number
Odometer reading
Fuel source identifier
Recorder name
Description of event (repair of exhaust system, replace injector, rotate tires, etc.)
Parts used or ordered and their costs
Total labor hours used

Total “down” time of the bus for the event

Other information can be collected to identify scheduled maintenance events, like changing oil or injectors, which occur at regular intervals. Maintenance costs can then be separated into scheduled and unscheduled. Fuel refilling will be recorded on these forms and this information will be essential to determining the fuel efficiency of the vehicles. Other information deemed pertinent to the specific operations in Mexico City, such as identifying the particular bus depot or work crew involved can easily be added to the reports.

These reports will be the principal method of assessing costs as well as other measures like fraction of the time the bus is running, the average amount of time between unscheduled maintenance events, etc. These reports can then be entered into a computer so that statistics on costs, etc. can be easily calculated and presented.

Field Test Responsibilities

The work crew will be trained in how to fill out the operations reports, and the crew managers will be charged with insuring that these reports are filled out in a satisfactory manner. Most transit agencies already have some kind of recording system for any work done on agency property, so these responsibilities should not be new to most bus maintenance crews. The copying and storage of the reports, and the entry of the data should be the responsibility of bus study managers. It is important the any special fuels to be used for the test buses are separated and cared for by the crew or depot managers, together with coordination with the bus study managers.

Laboratory Tests

One of the most important benefits of alternative fueled vehicles is their lower pollutant emissions. In order to be able to measure these benefits accurately, the emissions of each bus must be tested in laboratory conditions. The emissions testing will follow the Mexican standards on heavy vehicle testing. The tests described here assume these standards resemble those of the United States Environmental Protection Agency. The specific emissions to be tested are:

CO

CO₂

NO_x

SO_x

Hydrocarbons (Methane and Non-methane)

Particulate Matter (of sizes to be determined by the needs of the Mexican officials)

These are the most commonly tested emissions and are the only ones required by the U.S. EPA. Others, such as aldehydes, unburned fuel, oxygen, etc. can help to calculate a theoretical fuel efficiency, or help to inform more complex models of atmospheric chemistry. The final list of emissions to be tested should depend on the opinions of the Mexican officials, together with the group in charge of atmospheric pollution modeling (Multiscale Climate and Chemistry Model). The different emissions to be tested only changes the specific chemical analyzers to be used for the tests, and not the overall testing procedures.

Here, the U.S. EPA emissions tests will be generally described. Again, these procedures can be modified according to the needs of the Mexican officials.

The heavy-duty vehicle emissions tests take place over two days. The first day involves preparing the bus

with new filters, fuel, and making sure the bus is operating normally. The second day involves measuring the emissions as the bus is run through a series of simulated driving situations. First, the bus is started cold. Then, it is driven on the dynamometer according to a strict speed schedule which attempts to approximate the typical driving pattern of buses in New York and Los Angeles. These schedules can be modified to simulate the driving patterns typical to Mexico City. During the tests, the exhaust gases are collected for later analysis. The procedures for the analysis depend on the type of equipment used in the laboratory and the kinds of emissions involved in the tests.

Each bus test takes several hours to test on the dynamometer, depending on the setup and clean-up time. It seems that up to two buses could be tested each day. Emissions testing should occur on some schedule determined by the study authors and Mexican officials, but not less than once per year per vehicle.

Results are reported in emissions rates, in grams per kilometer, and can be compared from bus to bus, and loosely to buses in other countries and from different tests. Emissions can differ depending on the specific driving simulation used in the test.

Laboratory Test Responsibilities

The directors of the emissions laboratory will oversee the testing and report all relevant results to the bus study managers. How the laboratory is directed and where it is located is a decision to be made by the relevant Mexican officials.

Other Considerations

Bus study managers should coordinate laboratory tests with the field operators, so that operations can be planned and substitute buses can be reserved.

The fuels used during the field operations and laboratory tests should be monitored and tested for their actual chemical composition. This analysis can be done by various types of laboratories. The study managers should insure that fuels are ordered and are delivered to the laboratories, field operators and the emissions testing laboratories.

Annex 10

Cleaner Buses

Advanced Diesel Bus Advanced diesel buses are equipped with state-of-the-art emission control devices such as filters and catalysts which make them much cleaner than conventional diesel buses. The term "advanced diesel bus" is used for a bus which is equipped with one or more of these. In order to function properly, these devices require the use of low-sulfur diesel fuel which is more expensive. The California Air Resource Board (CARB) estimates that the incremental cost necessary to meet the standards set for 2007 will be less than 10,000 US\$ per bus. Some but not all of the technologies employed are already well established on certain markets. One of the future challenges for advanced diesel bus technology is the widespread distribution of low sulfur fuel.

CNG Buses Compressed Natural Gas (CNG) buses run on natural gas (which is mostly methane) which they burn in specially designed spark-ignition engines. Natural gas is relatively cheap and abundant, and it burns much more cleanly than diesel fuel. The greenhouse gas reduction potential is, on the other hand, negligible. Today CNG buses are the only commercial alternative to diesel buses. They require significantly higher investments, but the fuel itself tends to be cheaper. Overall cost effectiveness has to be assessed in the light of local economic background conditions. CNG buses are already being employed in a number of cities throughout the world. One of the main obstacles for further spreading is the lack of fuelling infrastructure.

Liquefied Petroleum Gas (LPG) Bus buses run on petroleum gas (which is mostly propane) which they burn in specially designed spark-ignition engines. As with natural gas, LPG burns much more cleanly than diesel fuel. The greenhouse gas reduction potential is, on the other hand, negligible. As a fuel, LPG is relatively widely used, with worldwide nearly 4 million vehicles running on propane. It has been used as a transportation fuel around the world for more than 60 years. LPG is in many ways similar to CNG, and the two fuels also share similar obstacles, such as higher investment necessity and the lack of fuelling infrastructure.

Fuel Cell Bus represent a new technology entirely different from that of the internal combustion engine. They use hydrogen gas as a fuel to produce electricity, the only emission being water vapor. Their energy efficiency and emission reduction potential make them attractive for use within polluted urban environments - their overall environmental performance however depends on the means of hydrogen production.

Fuel cell buses exist only as prototypes as yet and are extremely expensive compared to other alternatives such as CNG. Many experts consider fuel cells to be the technology of choice for the long-term future of urban transport. Currently however, they cannot be regarded as cost effective. A number of technological barriers must be overcome for fuel cell buses to reach market maturity - as for example hydrogen storage. There is currently intensive research going on in this field. This option is not being included in the test.

Hybrid Buses use two (or more) different energy conversion systems. The most common combination is that of an internal combustion engine with a battery and electric motor. Their main advantage is the reduction of emissions by means of greater fuel efficiency. As hybrid vehicles are still in the development stage, capital costs are currently high. These will be to some extent offset by fuel savings, and prices may

fall in the future if hybrid vehicles become more widespread. While some smaller hybrid vehicles are already available, hybrid buses exist only as prototypes yet.

Annex 11

Global Environmental Benefits

	Gas-Leve	Gas-Med	Gas-Grnde	Diesel-Grnde
1000 vehicles				
1998	200	40	0	16
1997	175	35	0	14
1996	150	30	0	12
1995	230	46	0	18.4
1994	260	52	1	20.8
1993	250	50	2	20
1992	230	46	14	18.4
1991	200	40	15	16
1990	180	36	9	14.4
85/89	250	50	9	20
80/84	200	40	0	16
75/79	175	35	0	14
sum	2500	500	50	200

Gas-Leve = personal cars, and taxis

Gas-Med = light trucks

Gas-Grnde = Micros

Diesel-Grnde = Heavy Trucks

fonte = "Inventario..."

1000 vehicle*kms/day				
1998	11506.85	2739.726	0	960
1997	9589.041	2205.479	0	840
1996	7808.219	1808.219	0	720
1995	11342.47	2520.548	0	1104
1994	12109.59	2706.849	200	1248
1993	10958.9	2397.26	400	1200
1992	9452.055	2079.452	2800	1104
1991	7671.233	1676.712	3000	960
1990	6657.534	1410.411	1800	864
85/89	7534.247	1438.356	1800	1200
80/84	4931.507	876.7123	0	960
75/79	3547.945	652.0548	0	840
total:	103109.6	22511.78	10000	12000
average kms/day	41.24384	45.02356	200	60

share of total vehicle kms in each vehicle age group:(this is used to multiply through the emissions factors)

1998	0.111598	0.121702	0	0.08
1997	0.092999	0.09797	0	0.07
1996	0.075727	0.080323	0	0.06
1995	0.110004	0.111966	0	0.092
1994	0.117444	0.120241	0.02	0.104
1993	0.106284	0.106489	0.04	0.1
1992	0.09167	0.092372	0.28	0.092
1991	0.074399	0.074482	0.3	0.08
1990	0.064568	0.062652	0.18	0.072
85/89	0.07307	0.063893	0.18	0.1
80/84	0.047828	0.038945	0	0.08
75/79	0.034409	0.028965	0	0.07

	Gas-Leve		Gas-Grnde Diesel-Grnd	
km/day		km/day		
1998	58	68	200	60
1997	55	63	200	60
1996	52	60	200	60
1995	49	55	200	60
1994	47	52	200	60
1993	44	48	200	60
1992	41	45	200	60
1991	38	42	200	60
1990	37	39	200	60
85/89	30	29	200	60
80/84	25	22	200	60
75/79	20	19	200	60

	Gas-Leve	Gas-Med	Gas-Grnde Diesel-Grnd	
1000*km/year				
1998	21	25	60	18
1997	20	23	60	18
1996	19	22	60	18
1995	18	20	60	18
1994	17	19	60	18
1993	16	17.5	60	18
1992	15	16.5	60	18
1991	14	15.3	60	18
1990	13.5	14.3	60	18
85/89	11	10.5	60	18
80/84	9	8	60	18
75/79	7.4	6.8	60	18

Modelo de Emisiones de Fuentes Moviles en la ZMVA

Using the Model:

The model works by changing the numbers of vehicles in circulation, or their daily mileage, in order to change the total vehicle-kms by vehicle type. This number is then multiplied by emissions factors (grams/km) which are calculated for the age and mileage distribution of the ZMVA - shown in the sheets labeled accordingly for each pollutant (but it is not necessary to look at this to run the model).

The *input* sheet is where the user inputs data for two scenarios, A and B, which are compared at the bottom.

The alternative modes are available for the user to input modes for which the emissions factors are different than the categories available. The two alternative modes' emissions factors are input by the user on the *alternatives* sheet. In the *input* and *alternatives* sheet, all user changes will be made in YELLOW blocks.

1. Input the fraction of all travel which is in congested conditions, labeled *Peak Share*
2. Change vehicle numbers, or daily mileage, by type
3. Add or change alternatives' emissions factors, and vehicle numbers or daily mileage.

Scenario Summaries:

		# Veh.	Km/dia	CO2 (kgs)	HC	CO	NOx	PM-10	SOx
A	Autos (trips)	9,000,000	9	17,681,344	136,168,434	1,205,212,834	100,478,829	2,065,549	6,210,000
	Taxis	100,000	200	4,270,856	32,890,926	291,114,211	24,270,249	498,925	1,500,000
	Pickup	500,000	75	9,976,602	133,276,599	1,110,498,460	57,796,397	934,174	3,593,750
	Micros	50,000	150	2,070,958	71,677,500	589,500,000	19,280,266	190,150	1,250,000
	Autobuses	10,000	150	2,214,221	7,326,780	13,890,000	23,616,120	1,909,625	312,500
	Garga (pesada)	200,000	100	29,522,942	97,690,400	185,200,000	314,881,600	25,461,667	4,166,667
	Alternative1	0	0	0	0	0	0	0	0
	Alternative2	0	0	0	0	0	0	0	0
	total grams:			65,736,922	479,030,638	3,395,415,505	540,323,460	31,060,089	17,032,917

Peak Share = 0.50

ton/day	65,737	479	3,395	540	31	17
ton/year	23,993,977	174,846	1,239,327	197,218	11,337	6,217

		# Veh.	Km/dia	CO2 (kgs)	HC	CO	NOx	PM-10	SOx
B	Autos (trips)	8,500,000	9	16,336,024	125,807,792	1,113,511,857	92,833,701	1,908,387	5,737,500
	Taxis	75,000	200	3,203,142	24,668,194	218,335,658	18,202,686	374,194	1,125,000
	Pickup	500,000	75	9,976,602	133,276,599	1,110,498,460	57,796,397	934,174	3,593,750
	Micros	40,000	150	1,656,767	57,342,000	471,600,000	15,424,213	152,120	1,000,000
	Autobuses	8,500	150	1,882,088	6,227,763	11,806,500	20,073,702	1,623,181	265,625
	Garga (pesada)	200,000	100	29,522,942	97,690,400	185,200,000	314,881,600	25,461,667	4,166,667
	Alternative1	1,500	200	300,000	240,000	750,000	1,500,000	60,000	39,000
	Alternative2	0	0	0	0	0	0	0	0
	total grams:			62,877,564	445,252,748	3,111,702,476	520,712,299	30,513,723	15,927,542

Peak Share = 0.50

ton/day	62,878	445	3,112	521	31	16
ton/year	22,950,311	162,517	1,135,771	190,060	11,138	5,814

Change from A to B = (B-A)/A	CO2 (kgs)	HC	CO	NOx	PM-10	SOx
absolute change: (tons)	-1,043,666	-12,329	-103,555	-7,158	-199	-403
Percent Change:	-4.3%	-7.1%	-8.4%	-3.6%	-1.8%	-6.5%

Annex 12

STAP Review Comments and Responses

The STAP review comments were provided by Mark A. Delucchi, from the Institute of Transportation Studies at the University of California. It is important to emphasize that his initial comments received were about the Project Brief. The Project Concept Document was prepared subsequently; he approved the last version of the PCD specifying the sections that had been improved.

The STAP comments to the Project Brief as well as to the PCD, and the final changes made to the PCD are explained in the following paragraphs:

1) His comment: The project brief should be better edited, there are too many acronyms so you need to provide a comprehensive list of them at the end of the brief. In some places, the font style changes and the use of headings and subheadings is not clear and consistent.

Action taken: We edited the final Project Concept Document (PCD), using font style "Times New Roman 11", and the diagram in annex 6 is done in "Arial 10". We also added the final acronyms list.

2) His comment: The organization and background information on the brief is not organized well enough.

Certain topics are scattered through the brief, rather than all in one place.

Action taken: The background information is now following a time sequence, and the organization of the document follows the PCD template.

3) His comments: It is difficult to understand the air-quality planning background.

Action taken: In the Strategic Context section we explain the background of the *Third Air Quality Management Plan* and continue with a clearly written section about the *Linkage to the Air Quality and Transport Project and timing of the GEF project*. In that section, it is specified the timing and objectives of the GEF project, which would be processed before the Bank loan (pgs 3-4). It is also exemplified on diagrams in Annex 6, *Timing of Policy Decisions in relation to GEF Project and WB Loan*, and the *Integrated Strategy for MCMA under WBI loan and GEF Project* (pgs 47-48).

Within the Government Strategy framework, we developed a section about *Environment Sector: Formulation of a long term, multi-sector, strategic framework*, in which the air quality management plan (2002-2010) is more detailed (pg 11).

4) His comments: Regarding the Bus demonstration program, it needs more technical discussion of the technology, operation, costs and expected emissions benefits of the program, it would also needs to clarify what the project intention in, and what are the expected benefits.

Action taken: The bus demonstration action is detailed in the component “C” of the project description named as *Field Test of Climate-Friendly High Capacity Vehicles*. This component specifies the field test details to be held by the GEF project in order to support a comparative pilot test for alternative bus and fuel technologies, including hybrid, CNG and diesel vehicles (pg 15). In section number 3, *Benefits and target population*, we specify the benefits that the project intends to yield (pg. 19). Finally, we developed particular annexes about the *Cost Field Test* (Annex 8 pg 51), *Fleet Size Bus Tests and General Protocol for Test of Climate Friendly Vehicles* (Annex 9 pgs 53-56), and *Cleaner Buses* (Annex 10 pg 57).

5) His comments: The sort of long-run planning it is not properly addressed.

Action taken: Component “A” of the project description, *Harmonization of sector strategies on air quality issues and Integrated Climate Action Plan for Transport (CAP) in the MCMA* refers to the process of integration between urban air quality and transport strategies. It also assists in the CAP (pg 14). Under the Government Sector Strategies, a description of the current Transport Plan is included, addressing its key goals. A new paragraph is also added in item C2cf with respect to land-use planning of the urban area (pg. 18).

6) His comments: the brief does not discuss some important measures designed to discourage automobile use, or at least mitigate some of the problems of automobile use.

Action taken: On the Government Strategy section, there is a description of the current *Transport Sector Strategy in the MCMA*, which details objectives to be achieved, and the applicable strategic measures (pg 11). In *Sector Issues to be addressed by the project*, we explain how would the project attend the major sector issues, such as a better harmonization of sector policies, lack of sustainable business environment for public transport, the contribution of the transport sector to the problem of air quality, and the global need for a comparative field test of low-carbon emitting vehicles (pg 12). Finally, in the *Key policy and institutional reforms to be sought*, we denote the issues about the integration of planning strategies, the

consolidation and rationalization of bus services, and the aid modal shift from private cars to public passenger transport (pg 17-18).

7) His comments: It is important to improve transit service.

Action taken: In both components, “B” and “D”, respectively *Definition of an enabling environment to facilitate the implementation of sustainable transport strategies* and, *Technical assistance and training for incorporation of climate change and air quality considerations in the design and analysis of transport strategies*, we emphasize the transit service (pgs 14-15).

8) His comments: The discussions of institutional changes and interactions among agencies, and between the public and private sector are often vague.

Action taken: We explain how the institutional arrangements are going to be held for the implementation of the GEF project. Mainly, the *executing agency* and the intersecretarial group for the coordination of the activities, and the *progress to date in project preparation* in which the different agencies have been involved since the preparation of the project (pg 20).

9) His comments: The key performance indicators of the project brief, are actions and not really measurable indicators.

Action taken: In the section, *Key performance indicators* we detail the actions will be been carried out (pg 2), and we also have included more specific performance indicators in the *Logframe Annex I* (pg 30-36).

10) His comments: Give a few more details on key parameters of the analysis with respect to the estimate of annual monetary benefits of pollution reduction

Action taken: We clarify that this is going to be one of the results of the implementation project.

11) His comments: Give some statistics on modal share or refer to fig 3.

Action taken: In the *Main sector issues* section related to the Transport Sector and Air Quality Issues, point number four expresses the *Gradual carbonization (increase of greenhouse gas emissions per passenger-km) of the transport sector: need for a modal shift to reduce emission of criteria pollutants and greenhouse gases*. We also exemplify (fig 3) the modal evolution in the public transport system in the MCMA, during the period 1983-1995 (pg. 9-10).

12) His comments: regarding the GEF Operational Strategy, the discussion of the “first approach” and the “second prong” is not clear.

Action taken: We rewrote the *GEF Operation Strategy* paragraph to clarify it (pg 5)

13) His comment: The Lack of sustainable business needs more discussion.

Action taken: In section, *Sector issues to be addressed by the project: lack of a sustainable business environment for public transport*, we explain in more detail how the sustainability of the public transport sector would be addressed. Specifically, through the support of studies and measures to obtain a modal shift that would result in a less carbon-intensive transport system (pg. 12).

14) His comments: Although the information in the table comparing technologies is not unreasonable, it needs to be developed in more detail.

Action taken: We clarify table No2, regarding *Alternative bus technologies* (pg. 13), as well as Annex 10, relative to *Cleaner Buses* (pg 57).

15) His comments: With respect to the non-motorized transport, you state that the construction of a new bike is necessary but not sufficient to raise bicycle use. It is important to specify what else is necessary.

Action taken: The clarification of the use of existing experiences and literature, has been added to Component B of the project description (Pg 14).

16) His comments: The section about integration of planning strategies is too vague.

Action taken: We add more detailed information explaining the benefits from harmonization of strategies, in section named *Need for a better harmonization of sector policies on the issue of Air Quality and on Climate Change* (pg 5-6).

17) His comments: Include more discussion in the section of Aid Modal Shift.

Action taken: We explain the key measure of the promotion of a modal shift as part of the government's strategy (pg.11).

18) His comments: A summary of the Incremental Cost Analysis (Annex 4) should be provided in the main text.

Action taken: We include an explanatory paragraph of the *Incremental Cost* (pg 16).

19) His comments: There are four ways to reduce GHG emissions, and not only two.

Action taken: In section *Project Rationale. Project alternatives considered and reasons for rejection*, we indicate the four ways to reduce GHG emissions (pg 21).

20) His comments: The paragraph about Local Air Management Matters, is too vague.

Action taken: We now have a concise paragraph of *The problem of Air Pollution in the Mexico City Metropolitan Area*, and the *Health Costs of Air Pollution* (pgs 2-3).

21) His comments: In the regulatory reform matrix several terms or expressions are not clear.

Action taken: We include a new Policy Matrix (pg 18-19).

22) His comments: regarding the discussion of Transmilenio (Annex 5), it needs to draw more explicit lessons and discuss them in the main text.

Action taken: The Annex 5 was re-elaborated. It incorporates the Transmilenio lessons in the main text, in *Transport Sector and Air Quality Issues* section (pg. 6).

23) His comments: Much of the information of Annex 4, it's from elsewhere in the brief.

Action taken: We re-elaborated the Annex 4 regarding *Incremental Costs*, and it is now consistent with the PCD.

24) His comment: More details on the calculations of the cost matrix table.

Action taken: We added a detailed *Incremental Cost Matrix* in *Annex 4* (pg. 39-43)

Annex 13

Simulation of the impact of corridors

Basis statistics on the transport sector

1. OPERATORS OF THE PUBLIC TRANSPORT OF MEXICO CITY

Summarizing table for transport means. Data of the year 2000

Operator	System	Passengers /day (1)	Lines / Routes	Length of the street net (km)	Fleet
Collective Transport System (Metro) (STC)	Metro	4.10	11	200.3	302
Electric Transport Service (STE)	Light Train	0.25	1	28.8	16
	Trolley Buses	0.06	17	422	340
Network of passenger transport (RTP)	Buses	0.46	100	2,356	1400
Concessionary Transport	Minibuses, buses and combination on fixed routes	18.00 (2)	1,070	U.D.	27,928
	Buses (3)	1.20	97	3,124	1197
Taxis	Taxis	1.30			102,110

(1) Numbers in millions

(2) Estimation based on obtainment per unit

(3) Refers to 9 concessionary bus companies operating on the routes AUPR-100

U.D. Undetermined

2. Coordination Mechanisms

The government of the city offers by means of the decentralized organizations STC, STE and RTP the following transport services: metro, light train, trolley buses and buses. The planning of these systems is carried out in a coordinated way between the SETRAVI and the corresponding organizations which assure the coordination. The title of the SETRAVI is part of the administrative council of the organizations.

In reference to the concessionary transport services the coordination is established through the headquarters of transport and of the regulation of transport which are in charge of the process of

concession, of regulation and of control of the concessions.

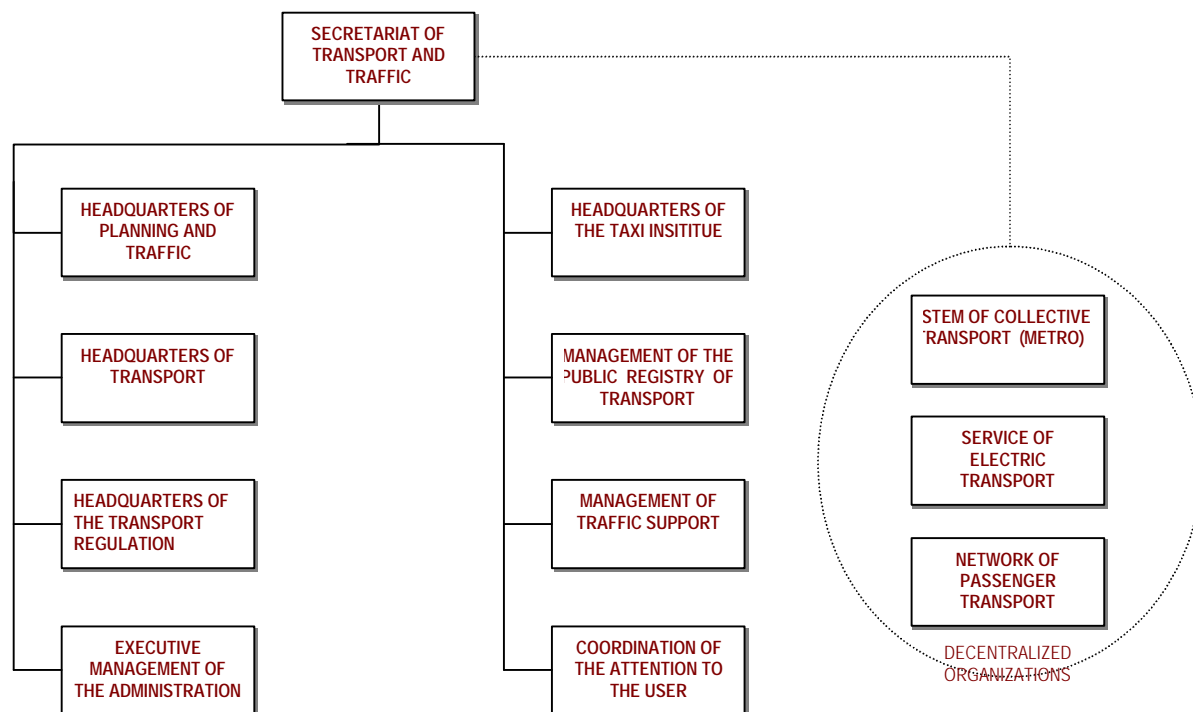
However, the regulation and control capacity is very limited with respect to the operation of the services.

For his part, the taxi institute takes care of the regulation of the taxi service. Like the concessionary transport for fixed routes, the capacity of the regulation and of the control of the services is limited to the management of concessions and to the control of vehicles.

Concerning the concessionary transport an annual program of vehicle inspection has been implemented by means of which is verified that the physical and mechanical conditions of the units are appropriate for the services.

It is hoped that through the implementation of the transport corridors the required mechanisms for the coordination, the supervision and the control will be established in order to assure that the service offered corresponds to the necessities of the demand.

GENERAL CHART OF THE SETRAVI



FOOTNOTES

1 Mexico City would thus be one of the first cities in the hemisphere with a Climate Action Plan.

2 The two largest are Tokyo with 20 million and Mumbai with 18 million.

3 The MCMA covers an area of 4,945 km² or about 0.25% of the Mexican territory. It is sited at an altitude of 2,240m above sea level and surrounded by mountains having an average height of 3,200m and peaks of 5,400m which induces frequent thermal inversions in its atmosphere. At that altitude the oxygen contents of the air is 23% less than at sea level. Deforestation of the MCMA has caused disappearance of about 75% of the woods. Moreover, existing water ponds now are only one percent of their original size. Population of the MCMA has grown from 3.0 million in 1950 to 11 million in 1975 and 17.2 million in 1995. Most of the population growth has been outside the Federal District. Currently, the population of the MCMA is estimated at about 18.8 million of which 51% reside in the Federal District. Population growth is projected at an annual rate of 1.9% from year 2000 to 2010 and 1.5% from 2010 to 2025, i.e. a population of 22.7 million in 2010 and 28.4 million in 2025. The increased urban activity of the 4 million additional people expected to live in the MCMA by year 2010 would have an impact on the environment resulting in a deterioration of the quality of life.

4 Organización Latinoamericana de Energía

5 Since the power plants transform the natural gas into electricity with an efficiency of 34.7%, the total final energy consumed in the MCMA (592 PJ in 1998) is only 94 % of all the energy supplied to it. Consequently, in terms of total final energy consumption (592 PJ), the transport sector consumes 49%, the residential, commercial and public sectors consume 26%, and the industry consumes 25%. The agriculture sector consumes less than 0.17% of the total final energy. Regarding LPG, the residential, commercial, and public sector consume 85%, the transport 10.4%, and the industry 4.4%. Regarding electricity, 25.3% is generated in the MCMA and the balance is imported to the MCMA where 52% is consumed by the industry, 43% is consumed by the residential/commercial/public sectors, and 4% is consumed by the transport sector. Diesel is almost 100% consumed by the transport sector, natural gas is mainly consumed by power plants (41.5%) and industrial sector (58.4%) and LPG is consumed in 85% by the residential, commercial and public sectors.

6 At the time the study was conducted, the 1998 inventory had not been completed; thus it was decided by the consultants to base the study on the 1996 inventory.

7 Accounts for CO₂, and weighted CH₄ and N₂O emissions, according to IPCC.

8 Although the emissions of GHG associated to the use of electricity mostly originate in power plants located outside MCMA, they are accounted for in order to determine the contribution of the region to the national GHG emissions, and to help estimate the effect of potential energy efficiency measures adopted in the region.

9 According to the National GHG Emissions Inventory (1997), CO₂ emissions in 1996 accounted for 444,488,970 tons.

10 The experience in Bogota, where, through a concerted effort involving management, regulatory decisions and investments in infrastructure, has provided some much needed proof that the modal shift is possible. In a few months, the new transport system has been instrumental in shifting passengers from the small buses and other vehicles into the articulated large buses that make the core of the Transmilenio system. Transmilenio plans to gradually expand the new system until it covers over 85% of passenger trips at the end of a 15 year period.

11 All bus companies are now private, operating through a system of non-exclusive concessions by routes, with no subsidies. Just in Mexico City, which constitutes half of MCMA, there exist a fleet of around 28,400 buses, of which 1,400 are regular-size units, 23,000 mini-buses, and 4,000 are 10-seat units named 'combies'. Since most companies are self-owned by operators with a single bus, it can be estimated that the number of firms providing bus services within MCMA may well exceed several thousand. Tariffs are regulated –the normal fare is now set at 3.0 pesos- but it is not controlled thereafter. **Metro.** Metro services are provided by a public company owned by the government of the Federal District (STC, Sistema de Transporte Colectivo). It runs an extensive 178 km network, with 10 lines and 154 stations, which covers the whole area of Mexico D.F. Tariffs are very low by international standards (P\$1.5 per trip, independently of traveled distance within the network), since they are set according to a social policy of providing cheap transport for low-income groups, which apparently constitute the main users of metro. Furthermore, services are free for old-age and disabled persons. Due to its tariffs' policy, cost coverage by STC is only around 50%. Subsidies are received from the Mexico D.F. government, which in 1997 amounted to P\$810 million (about US\$ 85 million equivalent) for operating expenses, plus another P\$56 million for investment (US\$ 6 million equivalent). **Light train/Trolley bus.** All non-metro electrical transport services provided within Mexico D.F. are responsibility of STE (Servicio de Transportes Eléctricos, also a public company). It runs a single light-train 29 km line, transporting 90,000 passengers a day, and a 410-km network of trolley-buses with 220,000 passengers a day.

- 12 The idle mode of a hybrid vehicle is being electrically powered to reduce emissions; the electric generator reduces overall fuel usage; friction energy from the breaks is used to generate electricity.
- 13 The STE anticipates that it will obtain clearance to increase tariffs by end of the current year.

MEXICO

INTRODUCTION OF CLIMATE FRIENDLY MEASURES IN TRANSPORT

CONTENTS

A. Project Development Objective

1. Project development objective
2. Key performance indicators

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project
 - The Problem of Air Pollution in the Mexico City Metropolitan Area
 - Third Air Quality Management Plan
 - Health Costs of Air Pollution
 - Linkage to the Air Quality and Transport Project and timing of the GEF Project
 - Linkage to CAS
 - 1a. global operational strategy/ Program objective addressed by the project

2. Main sector issues and Government strategy

Need for a better harmonization of sector policies on the issue of air quality and on climate change

Transport sector and air quality issues

- i) Lack of a sustainable business environment for public transport
- ii) Large contribution of the transport sector to the problem of air quality
- iii) Congestion and low productivity in the transport sector
- iv) Gradual carbonization of the transport sector: need for a modal shift to reduce emission of criteria pollutants and greenhouse gases

Government Strategy

Transport Sector Strategy in the MCMA

Environment Sector: formulation of a long term, multi-sector, strategic framework

3. Sector Issues to be addressed by the project

- Strategic choices

C. Project Description Summary

1. Project components
2. Key policy and institutional reforms supported by the project
3. Benefits and target population
4. Institutional and implementation arrangements

- D. Project Rationale
 - 1. Project alternatives considered and reasons for rejection
 - 2. Major related projects financed by the Bank and other development agencies
 - 3. Lessons learned and reflected in proposed project design
 - 4. Indications of borrower and recipient commitment and ownership
 - 5. Value added of Bank and Global support in this project
- E. Issues Requiring Special Attention
 - 1. Economic
 - 2. Financial
 - 3. Technical
 - 4. Institutional
 - 5. Environmental
 - 6. Social
 - 7. Safeguards policies
 - 8. Business policies
- F. Sustainability and Risks
 - 1. Sustainability
 - 2. Critical risks
- G. Project Preparation and Processing

Annexes

- Annex I: Project Design Summary
- Annex 2: Project Preparation Plan
- Annex 3: Project Processing Timetable
- Annex 4: Incremental Costs
- Annex 5: Transmilenio Mass Transit System
- Annex 6: Timing and Integrated Strategy
- Annex 7: Center for Sustainable Transport, Energy and Environment
- Annex 8: Cost of Field Test
- Annex 9: Fleet Size for Bus Tests
- Annex 10: Cleaner Buses
- Annex 11: Global Environmental Benefits
- Annex 12: STAP Review Comments and Responses
- Annex 13: Simulation of the impact of corridors

Acronyms

AQM	Air Quality Management Plan
BANOBRAS	Banco Nacional de Obras y Servicios Públicos
CAM	Comisión Ambiental Metropolitana Metropolitan Environmental Commission
CAP	Climate Action Plan
CAS	Country Assistance Strategy
CEC	Environmental Cooperation Commission
CEIBA	Centro Interdisciplinario de Biodiversidad y Ambiente Biodiversity and Environment Interdisciplinary Center
COMETRAVI	Comisión Metropolitana de Transporte y Vialidad Metropolitan Commission of Transport
COP 7	Conference of the Parties No. 7
GEF	Global Environment Facility
GHG	greenhouse gas
IMECA	Metropolitan Index of the Quality Air Indice Metropolitano de la Calidad del Aire
IMP	Instituto Mexicano del Petróleo Oil Mexican Institute
INE	Instituto Nacional de Ecología National Institute of Ecology
IPCC	Intergovernmental Panel of Climate Change
MCMA	Mexico City Metropolitan Area
OLADE	Organización Latinoamericana de Energía Latin-American Energy Organization
OP11	Operation Program 11
PHRD	Program for Human Resources Development
PICCA	Programa Integral para el Control de la Contaminación Atmosférica Integral Program for the control of the Atmospheric Pollution
PIU	Proyect Implementation Unit
PROAIRE	Programa para Mejorar la Calidad del Aire de la Zona Metropolitana del Valle de México Program to Improve the Air Quality in the Metropolitan Area
RAMA	Red Automática de Monitoreo Atmosférico Automatic Network of Atmospheric Monitoring
SETRAVI	Secretaria de Transporte y Vialidad del Gobierno del Distrito Federal Secretary of Transport
SCT	Secretaria de Comunicaciones y Transporte del Estado de México Secretary of Communications and Transport
SMA	Secretaria de Medio Ambiente del Gobierno del Distrito Federal Environmental Secretary for the City

STE	Sistema de Transportes Eléctricos Electric Transport System (Bus Operators System)
WRI	World Resources Institute

